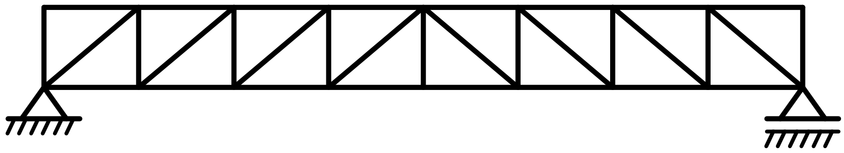
Trusses الجمالونات



نسألكم الدعاء

IF you download the Free ***APP.*** RC Structures YASSER EL LEATHY *on your smart phone or tablet, you will be able to play illustrative movies For any paragraph that has a QR code icon*

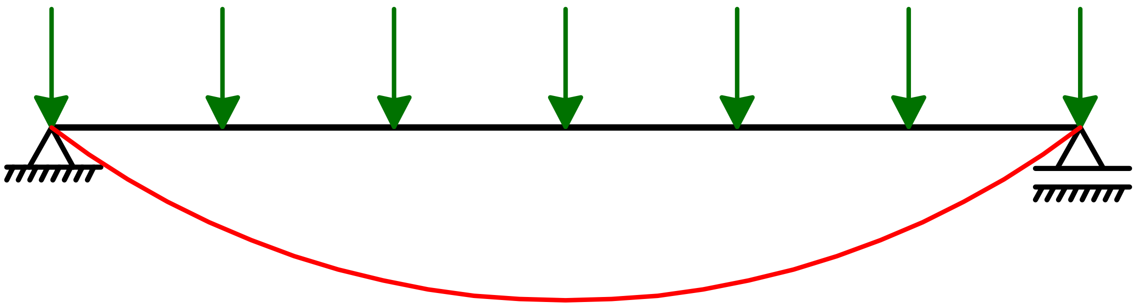
اذا حملت تطبيق RC Structures YASSER EL LEATHY على تليفونك المحمول او اللوح السطحى ستستطيع أن تشغل أفلام شرح للمقاطع التى تحتوى على رمز

Truss. Table of Contents.

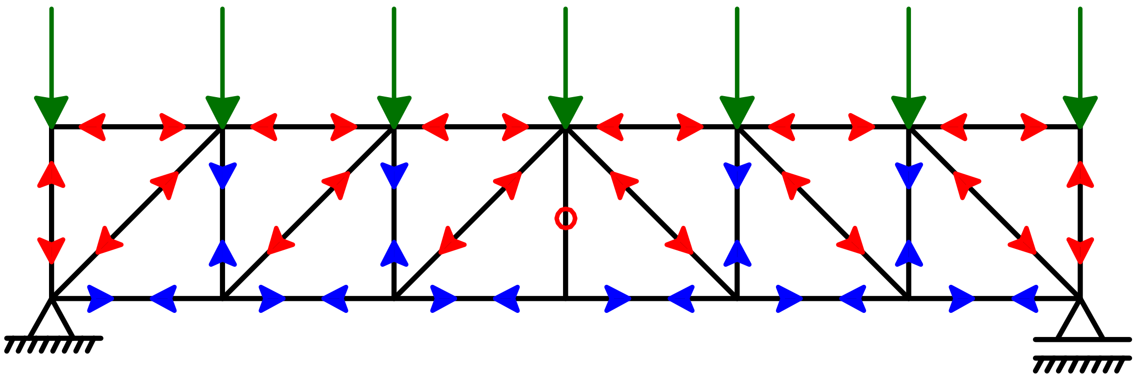
Introduction.

تعتمد فكره ال *truss* على تحويل ال *Bending moment* الى *Couple*
اى الى *Tension Normal Forces* & *Compression Normal Forces*
و ذلك للتوفير لانه عند تصميم قطاع عليه *pure Compression* ستكون كميه الخرسانه
و الحديد قليله مما يعمل على تقليل ثمن ال *member*
و عند تصميم قطاع عليه *pure Tension* تكون كميه الحديد كبيره و كميه الخرسانه
قليله و تكون ايضا نسبيا ثمن ال *member* أقل .

Beam



Truss



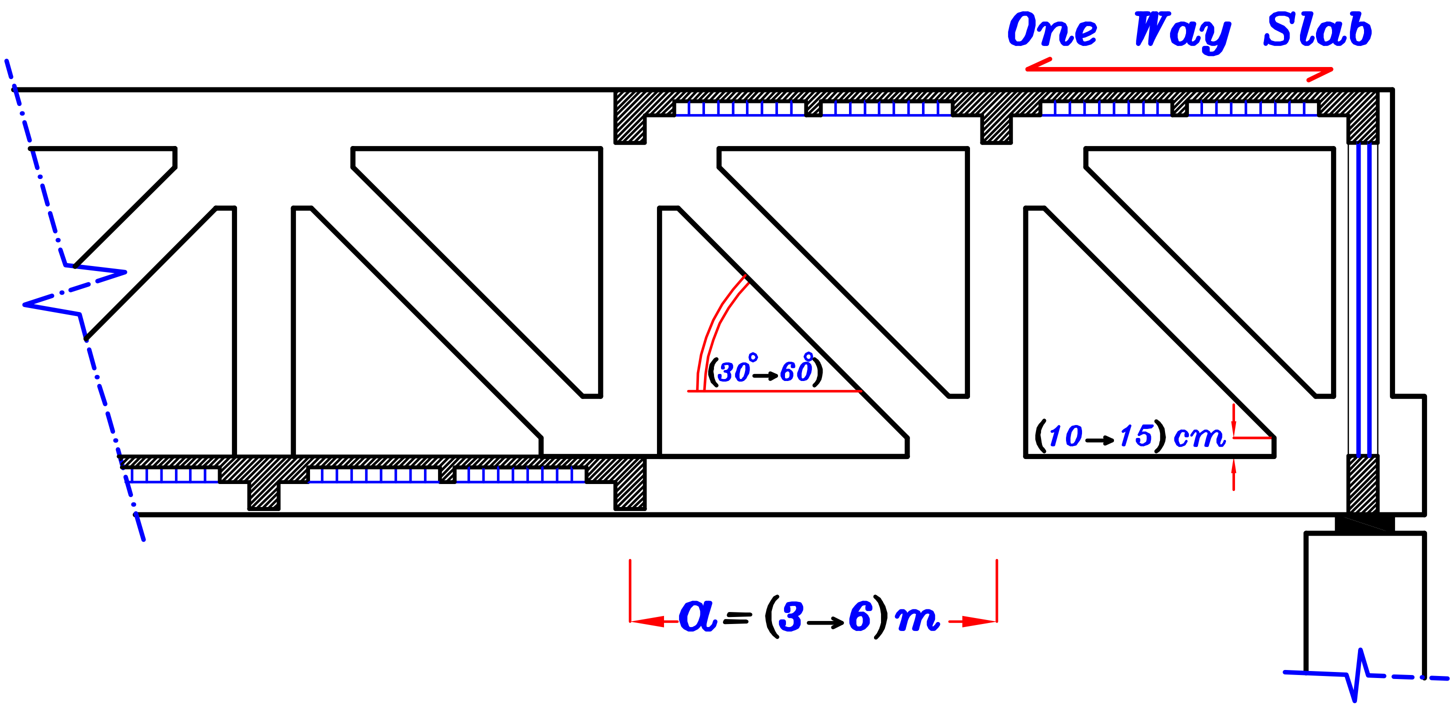
و لكى نضمن أنه لا يوجد عزوم على ال *members*

يجب أن تكون كل الاحمال مركزه عند ال *Joints* فقط و لكى نتحكم فى ذلك يجب أن :

١- نضع كل الكمرات المحموله على ال *Truss* عند ال *Joints* فقط .

٢- نأخذ كل البلاطات *One Way Slabs* فى إتجاه الكمرات بحيث لا ترمى أى أحمال على ال *Truss* (عاده تؤخذ *One Way H.B. slab*) .

٣- نفرض أن ال *O.W.* لل *Truss* يؤثر كأنه *Concentrated Load* عند ال *Joints*.



لتحديد نوع القوى (شد أو ضغط) فى ال members يكون حسب شكل ال B.M. و شكل ال Truss .

* Upper & Lower Chord

إذا كان ال member فى نفس إتجاه ال B.M. يكون عليه شد .

إذا كان ال member عكس إتجاه ال B.M. يكون عليه ضغط .

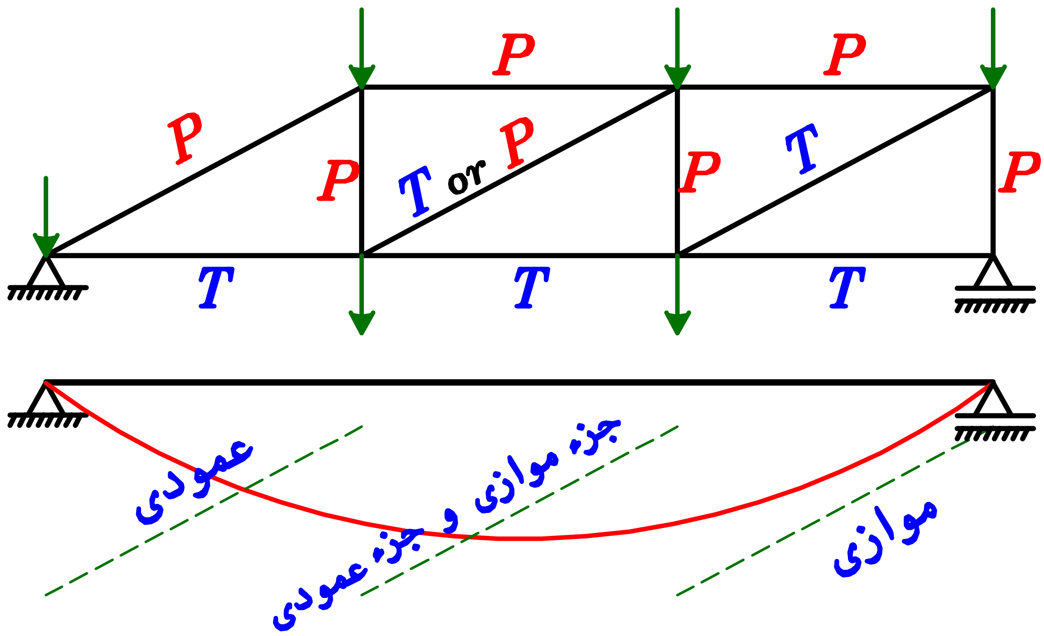
* Diagonal members

إذا كان ال member موازى لل moment يكون عليه شد.

إذا كان ال member عمودى على ال moment يكون عليه ضغط.

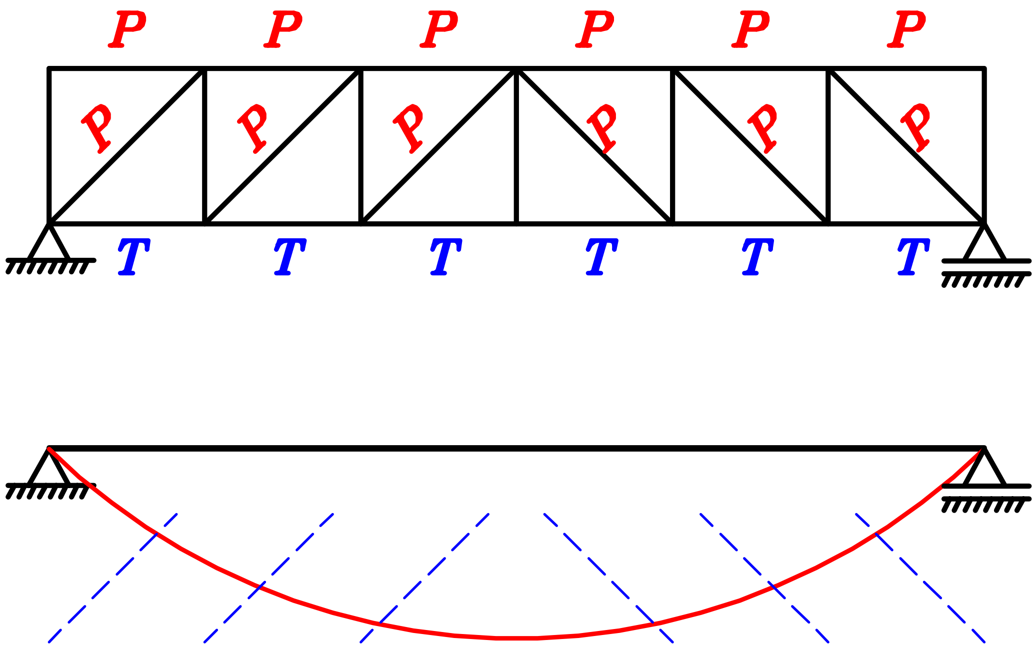
* Vertical members

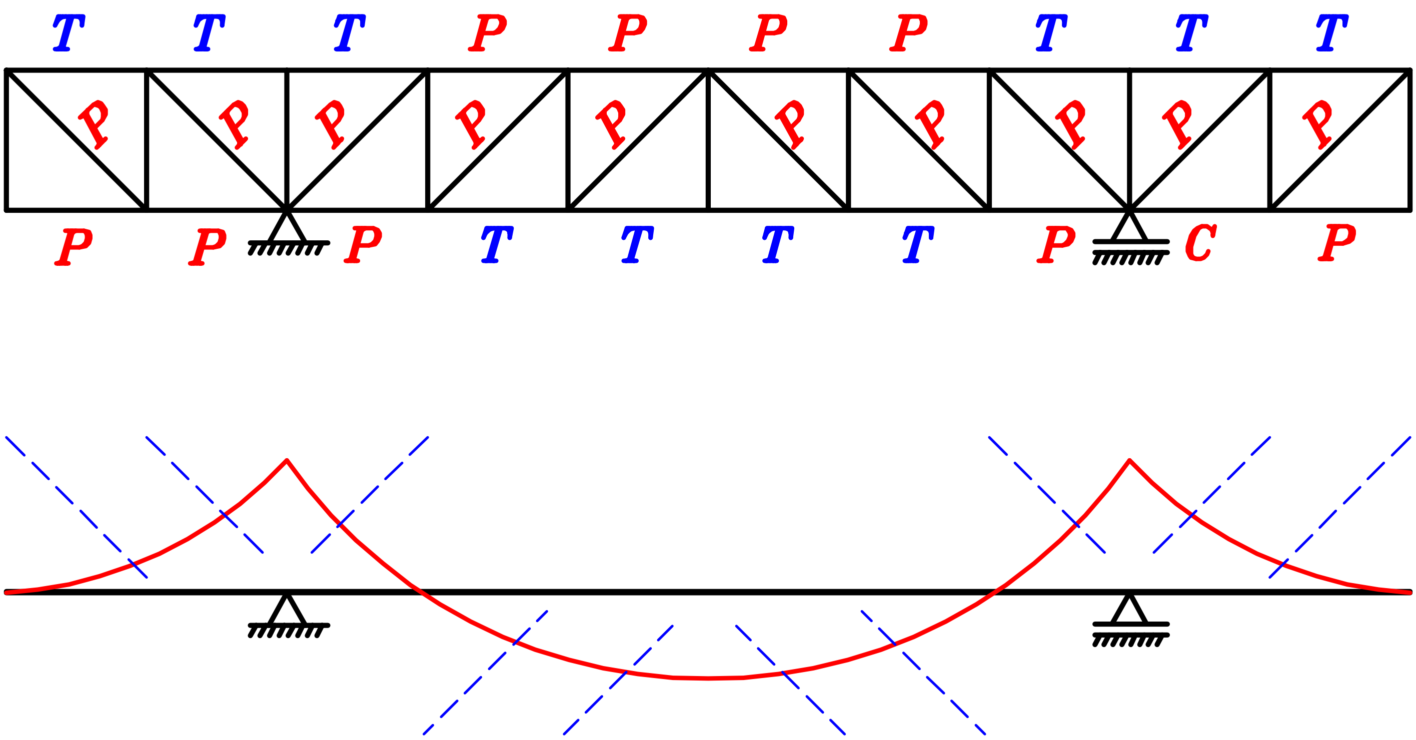
عاده يكون عليها ضغط إلا فى حالات خاصه .

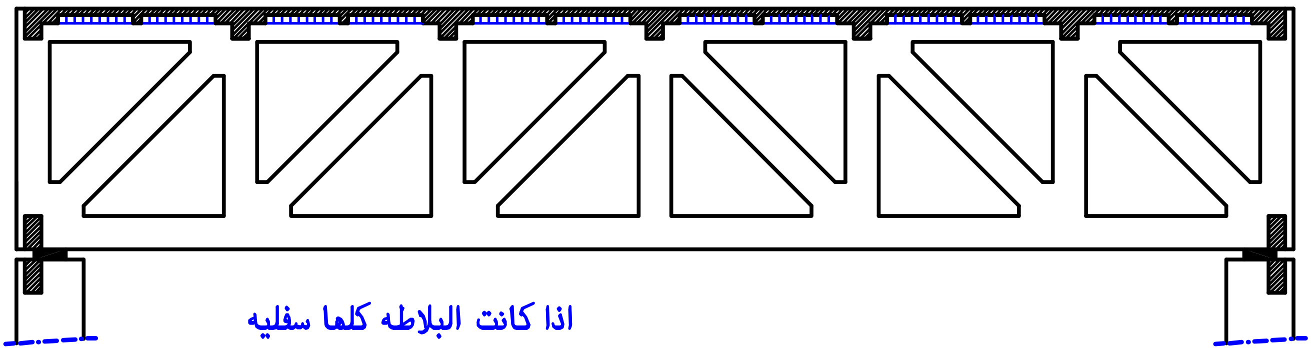


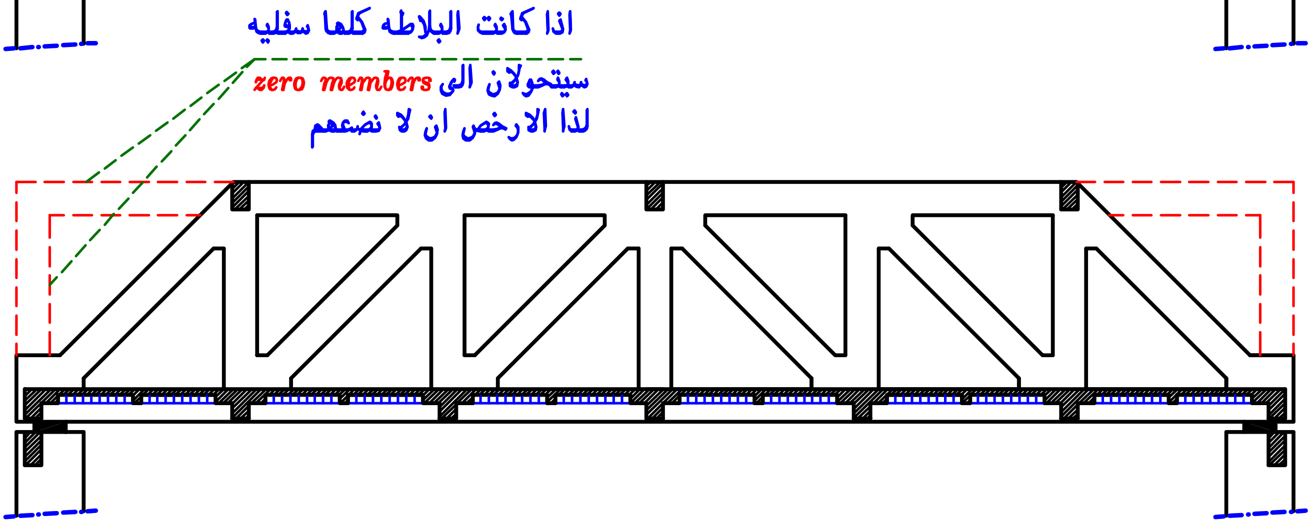
حيث أن الخرسانه أفضل فى الضغط من الشد (عكس الـ *Steel*)

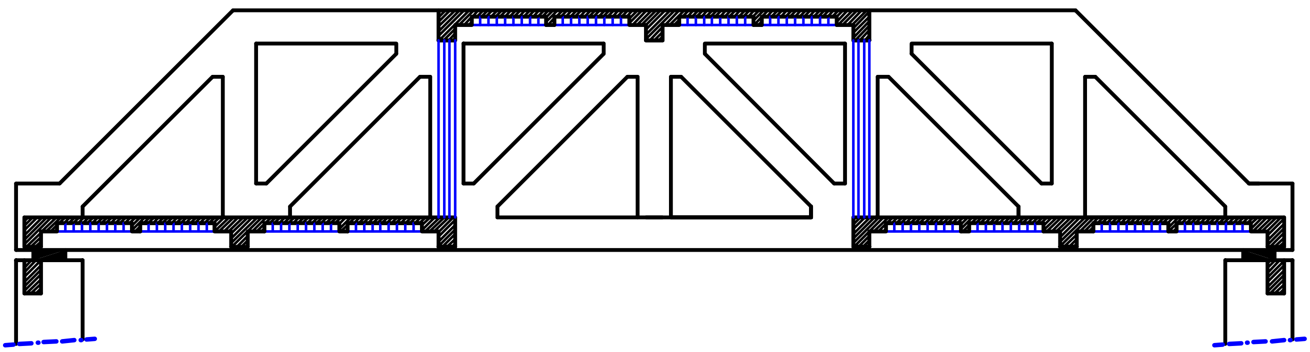
∴ فمن المفضل وضع الـ ***Diagonal members*** عمودية على شكل الـ ***B.M.*** لكى تكون معرضه للضغط .

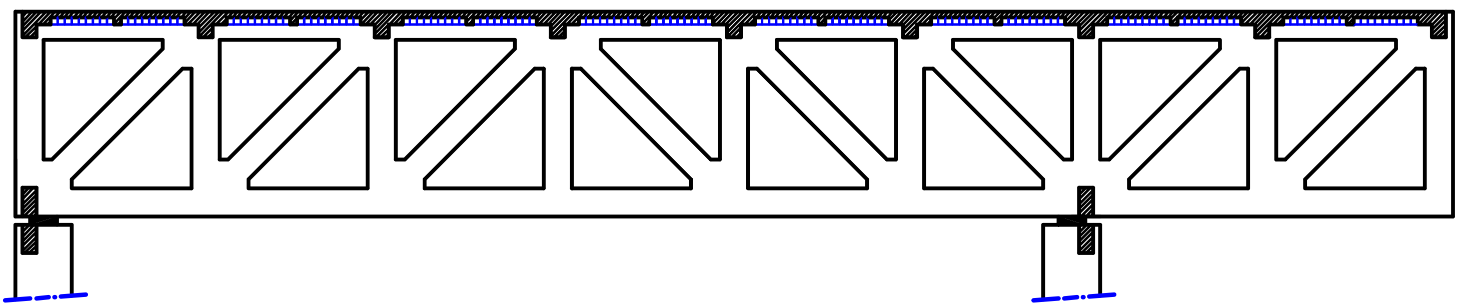


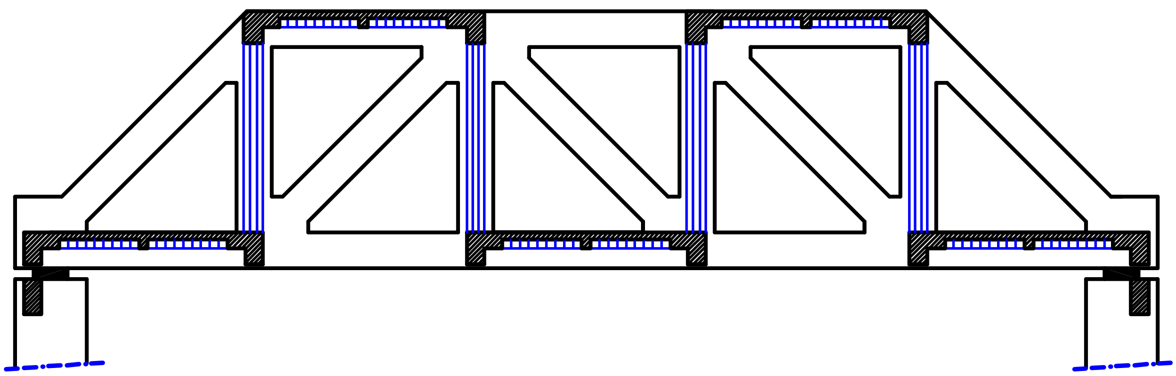


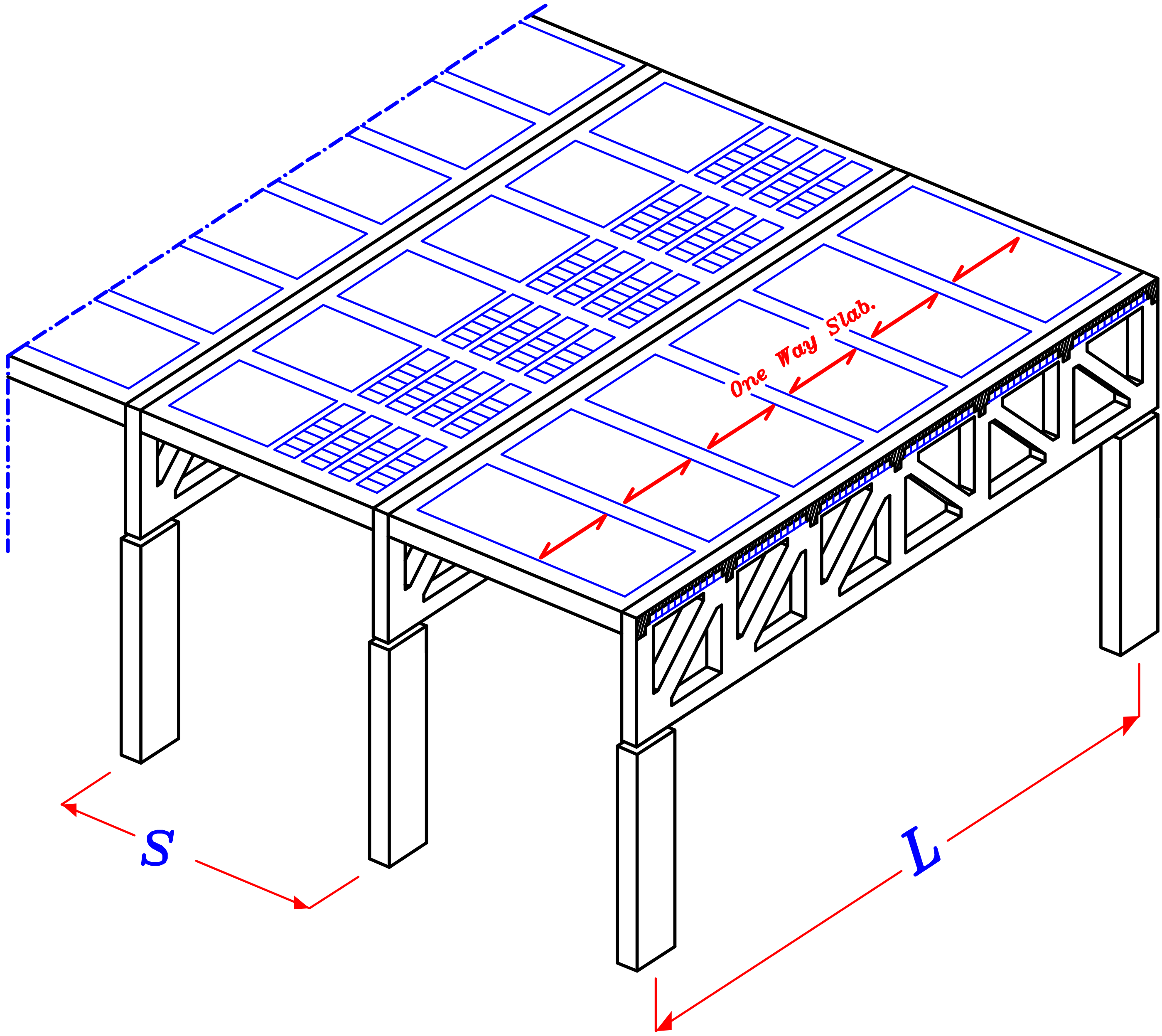


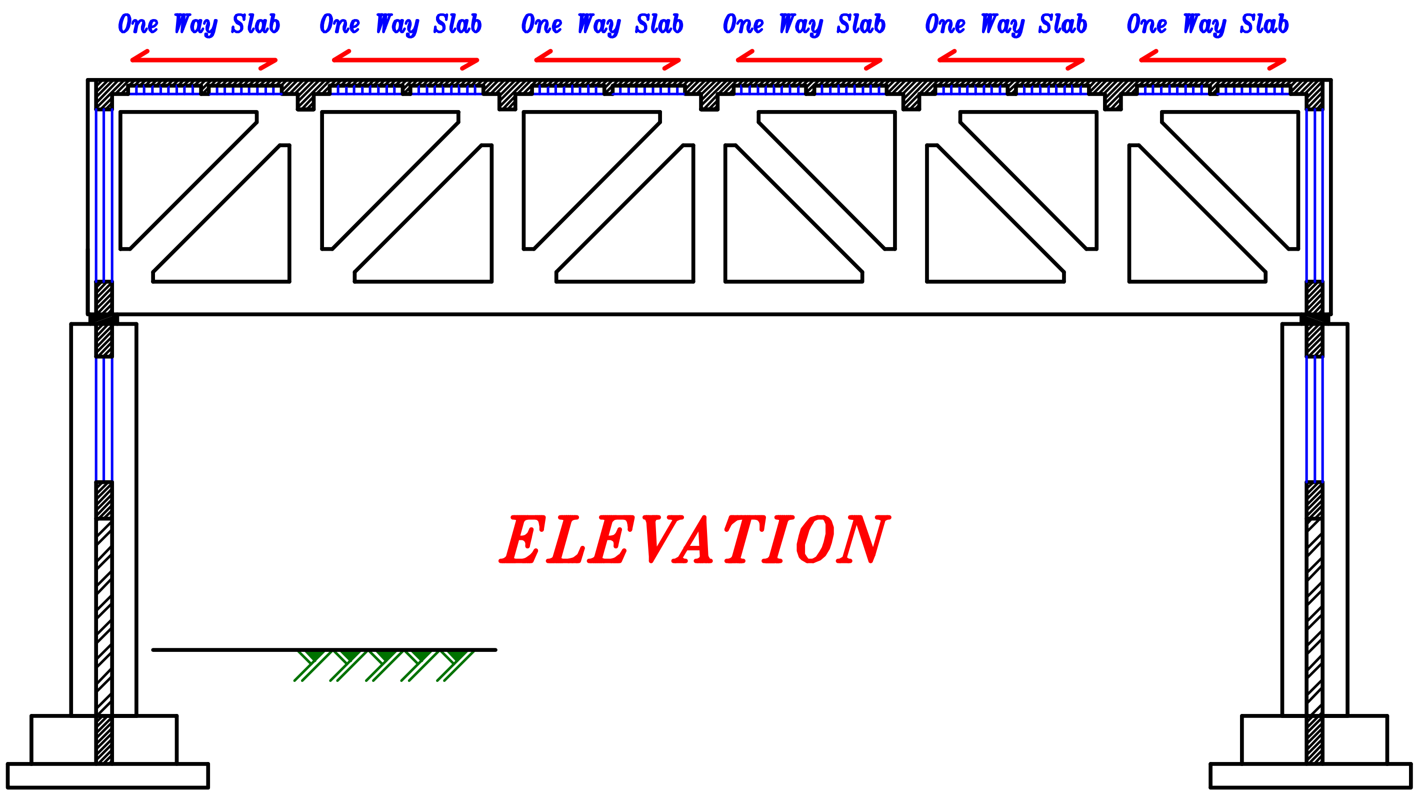

اذا كانت البلاطه كلها سفليه
سيتحولان الى zero members
لذا الارخص ان لا نضعهم



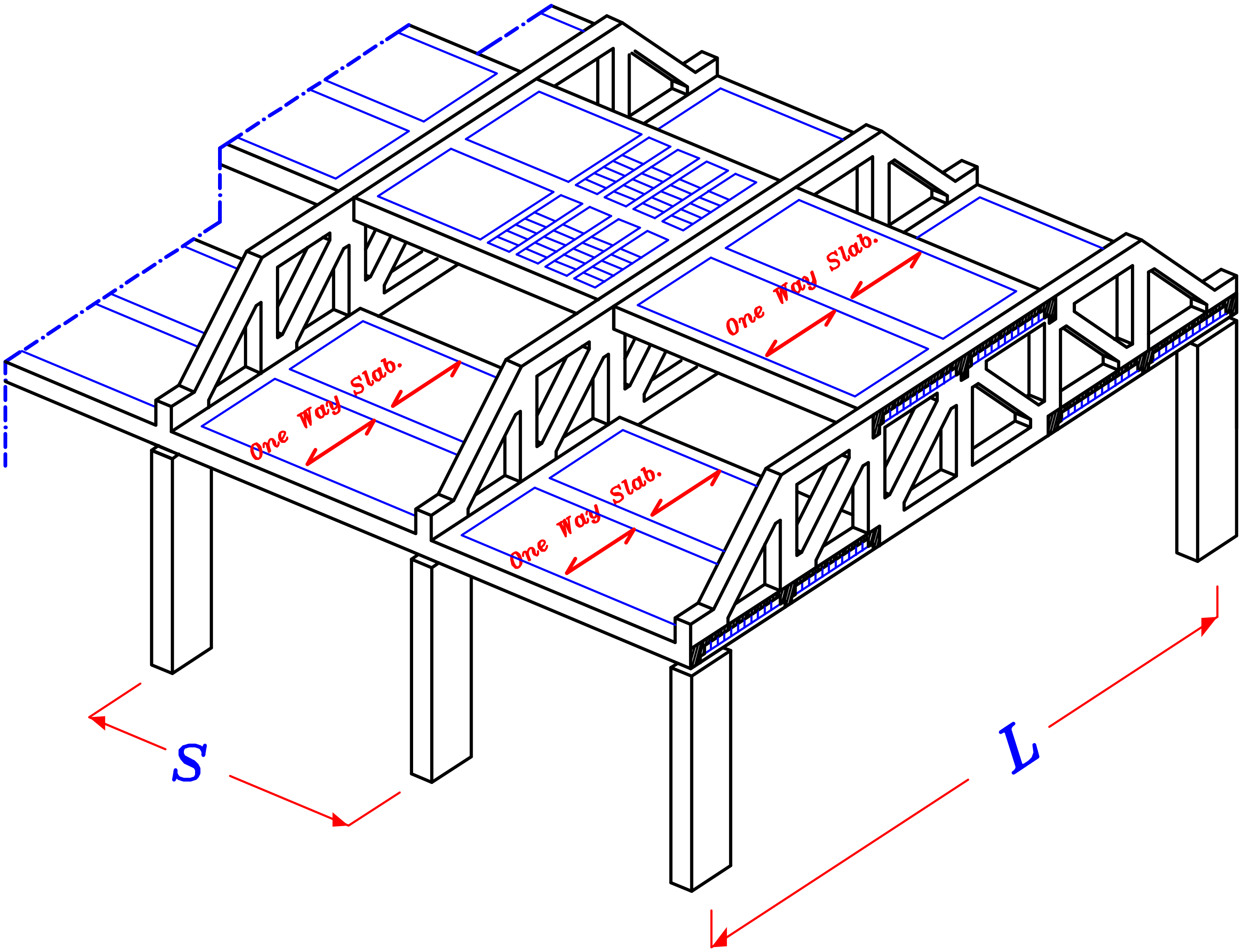





One Way Slab.
S
L


One Way Slab
One Way Slab
One Way Slab
One Way Slab
One Way Slab
One Way Slab

ELEVATION


One Way Slab.
One Way Slab.
One Way Slab.
S
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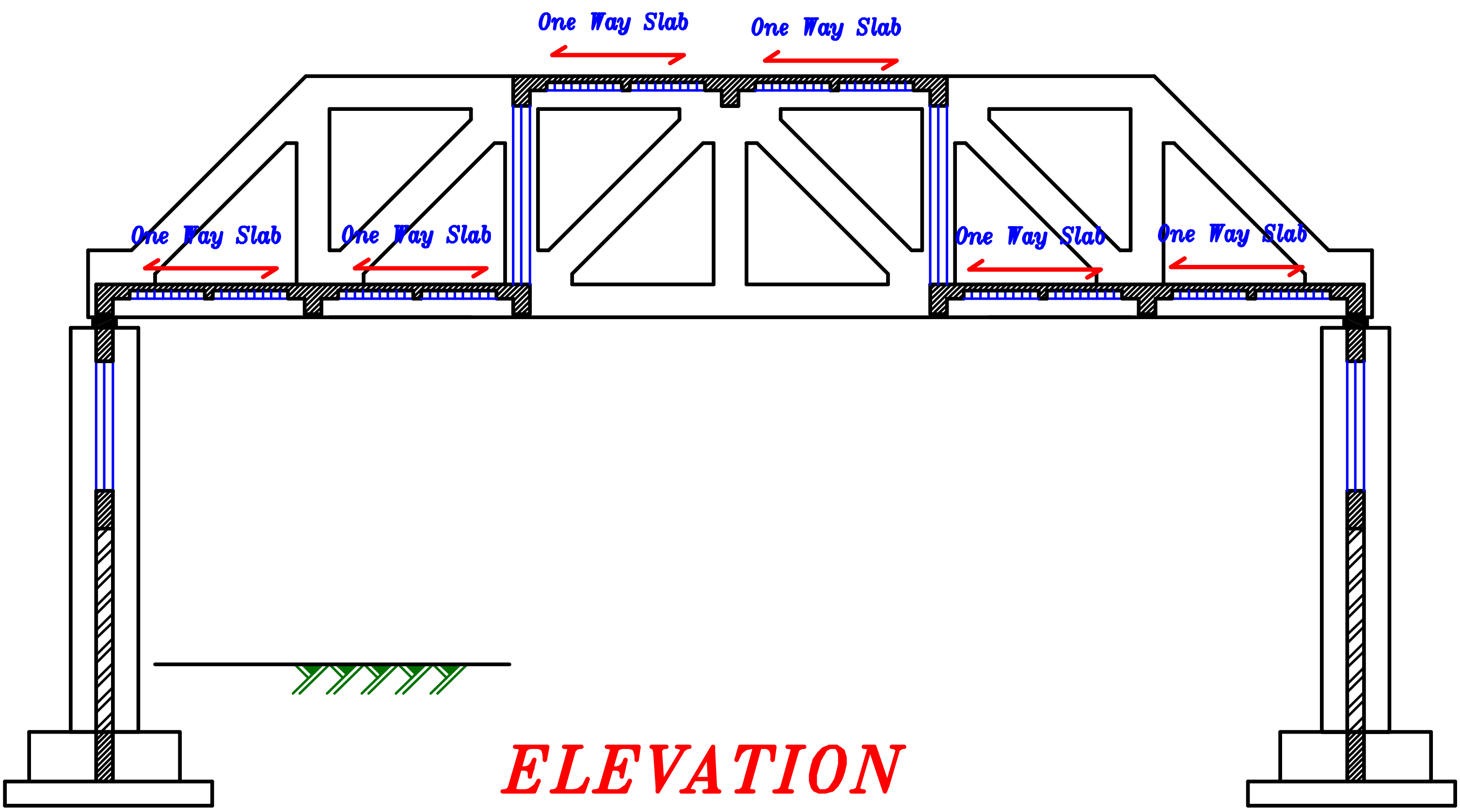
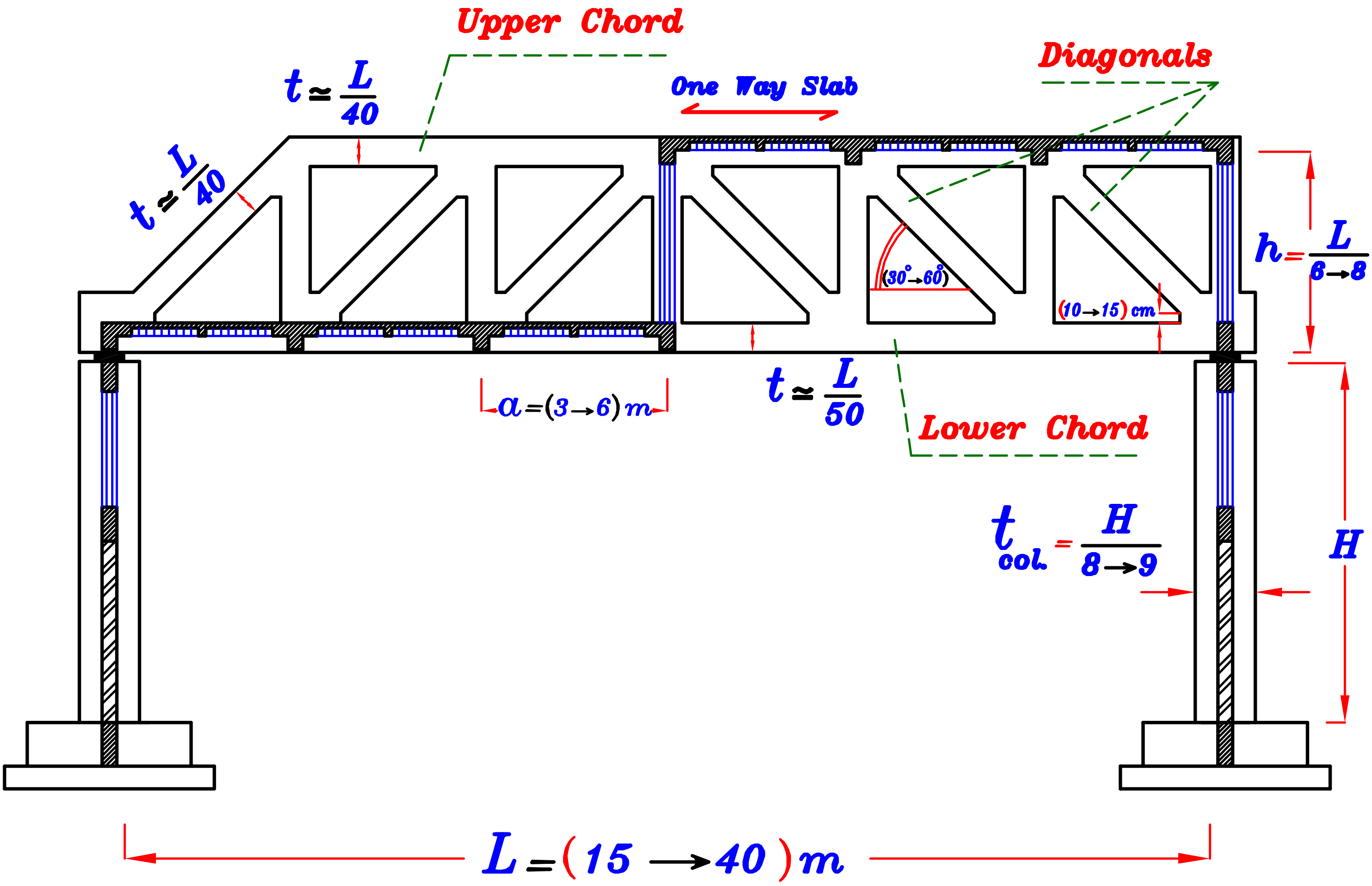
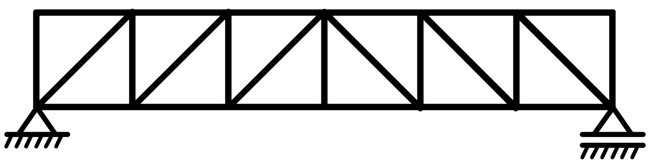

One Way Slab
One Way Slab
One Way Slab
One Way Slab
One Way Slab
One Way Slab

ELEVATION

Concrete Dimensions.



* Span $(L) = (15 \to 40)\ m$
* Height $(h) = \dfrac{L}{6 \to 8}$
* t (Compression members) $\simeq \dfrac{L}{40}$
* t (Tension members) $\simeq \dfrac{L}{50}$
* $b = \left.\begin{array}{l} 0.30\ m \\ \dfrac{\text{Spacing}}{20} \end{array}\right\}$ الأكبر
* $t_{col.} = \dfrac{H}{8 \to 9}$



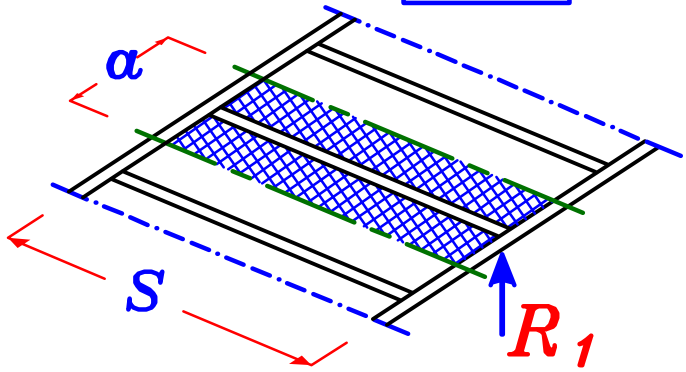
Statical System

Steps of Design.

① **Get Loads on Beam B_1**

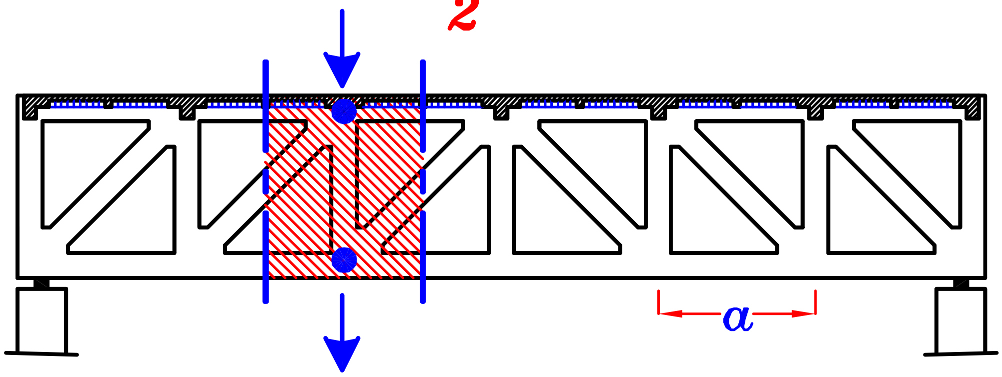
$$w_1 = O.W._{(beam)} + \left(\frac{w_{rib}}{S}\right) * a$$

$$R_1 = w_1 * S$$



② **Take**

$$F = \frac{o.w. * a}{2} + R$$



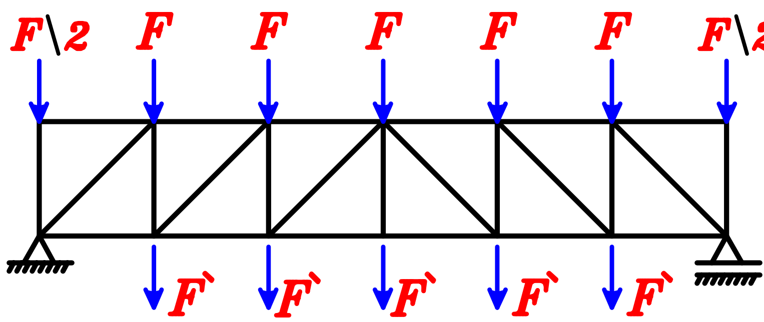
$$F` = \frac{o.w. * a}{2}$$

$o.w.$ (Truss) $\simeq$ 17.5 kN\m` (U.L.)

$$\boxed{F = R_1 + \frac{o.w. * a}{2}} \qquad \boxed{F` = \frac{o.w. * a}{2}}$$

③ **Solve the Truss,**

By using.



ⓐ **Method of Sections.**

ⓑ **Joints Equilibrium.**

Then get N.F. on all members.

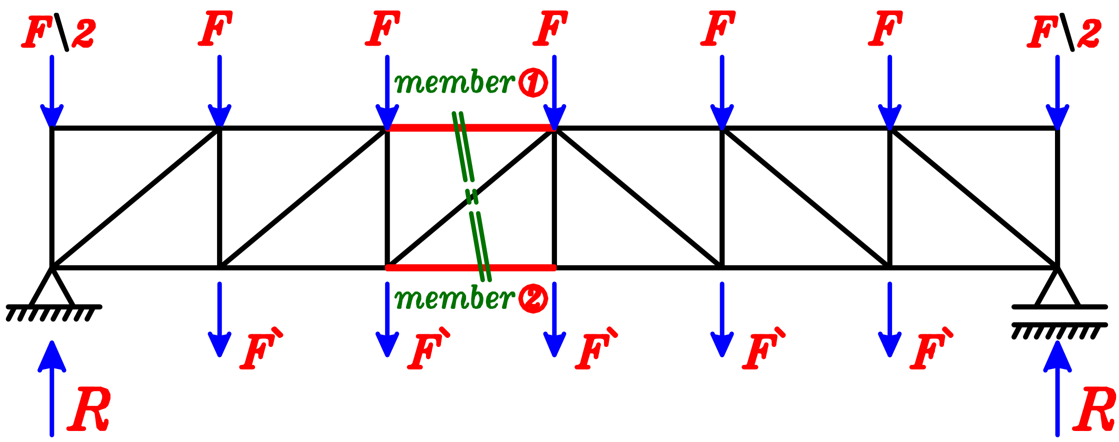
بالطبع المفروض حل الـ **Truss** بالكامل و غالبا يكون بالكمبيوتر .

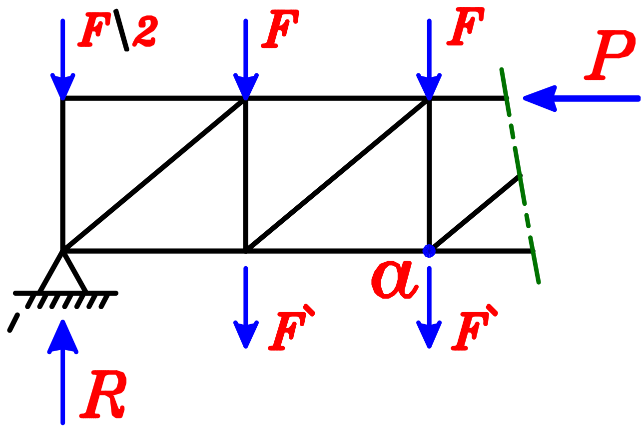
لكن فى هذا الملف نظرا لضيق الوقت فسنعمل مثل الدراسه فى الكليه

بأن نحدد القوى فى **2 Members** فقط و هما أكبر **Compression Force**

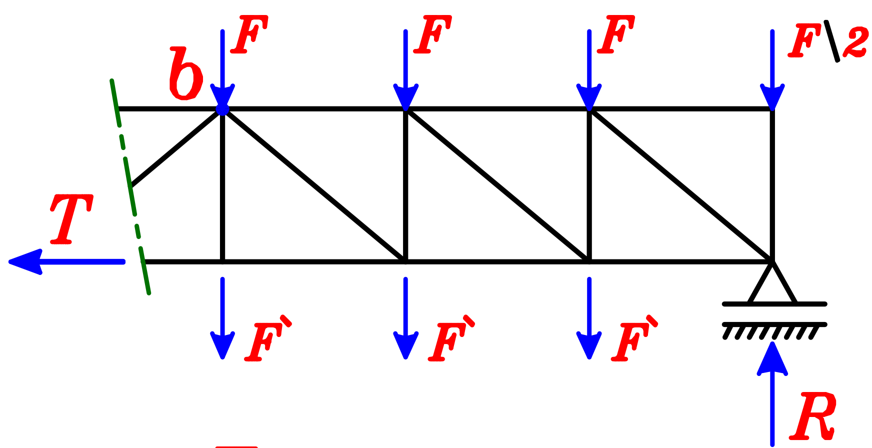
و أكبر **Tension Force** و نصممهم و نضع تسليحهم فى باقى الـ **Truss**

و يفضل استخدام **Method of sections**





$\sum M$ at joint a = Zero $\xrightarrow{Get}$ P Comp. Force at member ①



$\sum M$ at joint b = Zero $\xrightarrow{Get}$ T Ten. Force at member ②

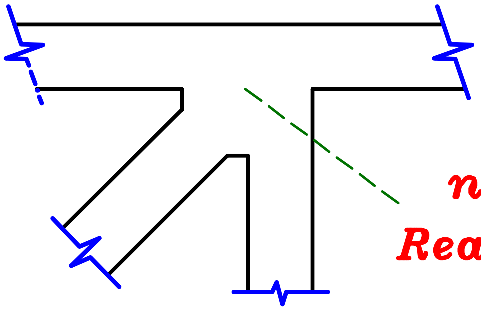
④ Calculate moment of truss members.

ستتكون عزوم على ال members المختلفه نتيجه :

ⓐ The joints are not a Real Hinges.

فى الحقيقه ال joint لن تكون Real Hinge كما فرضنا فى الحسابات

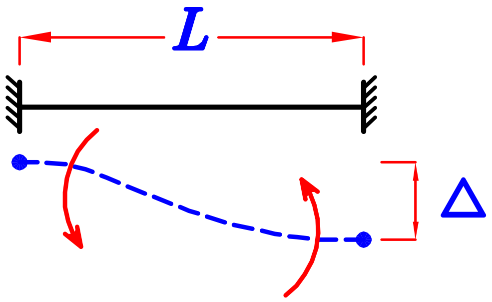
لذا سيتكون عزم صغير (غير معلوم الاتجاه)



ⓑ Relative Displacement of joints.

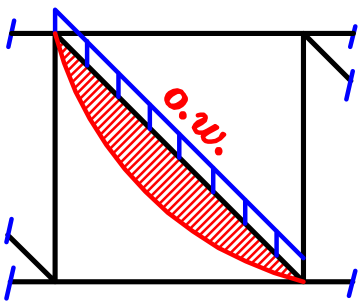
عند حدوث deflection لل Truss تحدث ازاحات غير متساويه لل joints

و لان فى الحقيقه ال joints ليست Real Hinge فسيحدث عزم نتيجه فرق الازاحه



$$\boxed{M = \frac{6 E_c I}{L^2} \triangle}$$

ⓒ Due to O.W. of the member.



$$\boxed{\frac{e}{t} \simeq 0.1 \longrightarrow 0.2}$$

نحسب قيمه ال moment كقيمه تقريبيه من العلاقه

حيث t هى عمق القطاع

For Comp. members.

$$\frac{e}{t} = 0.1 \longrightarrow e = 0.1 * t \longrightarrow \frac{M}{P} = 0.1 * t \longrightarrow \boxed{M = 0.1 * t * P}$$

For Ten. members.

$$\frac{e}{t} = 0.1 \longrightarrow e = 0.1 * t \longrightarrow \frac{M}{T} = 0.1 * t \longrightarrow \boxed{M = 0.1 * t * T}$$

⑤ Design of Members.

ⓐ Design of Compression members.

Designed on P , M

P From calculation of Truss

M From $\frac{e}{t} \simeq 0.1 \longrightarrow \boxed{M = 0.1 * t * P}$

Because $\frac{e}{t} \simeq 0.1 < 0.5 \longrightarrow$ Use Interaction Diagram

$$\left.\begin{array}{l} \dfrac{P}{F_{cu}\, b\, t} \\ \\ \dfrac{M}{F_{cu}\, b\, t^2} \end{array}\right\} \text{Get } \rho \qquad \boxed{\text{IF } \rho < 1.0 \xrightarrow{\text{Take}} \rho = 1.0}$$

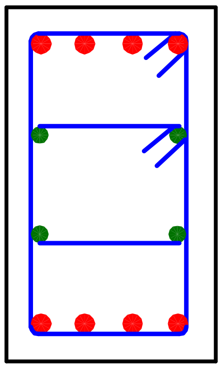
$$\mu = \rho * F_{cu} * 10^{-4}$$

$$A_s = A_s` = \mu\, b\, t$$

$A_s`$

2 ϕ12\25 cm

2 ϕ12\25 cm



A_s

Check $A_{s\,min.}$

Calculate $A_{s\,Total} = A_s + A_s`$

Calculate $A_{s\,min.} = \frac{0.8}{100} * b * t$

IF $A_{s\,Total} \geqslant A_{s\,min.} \quad \therefore$ o.k.

IF $A_{s\,Total} < A_{s\,min.} \xrightarrow{\text{take}} A_s = A_s` = \frac{A_{s\,min.}}{2}$

ⓑ Design of Tension members.

Designed on M, T

T From calculation of Truss

M From $\frac{e}{t} \simeq 0.1 \rightarrow \boxed{M = 0.1 * t * T}$

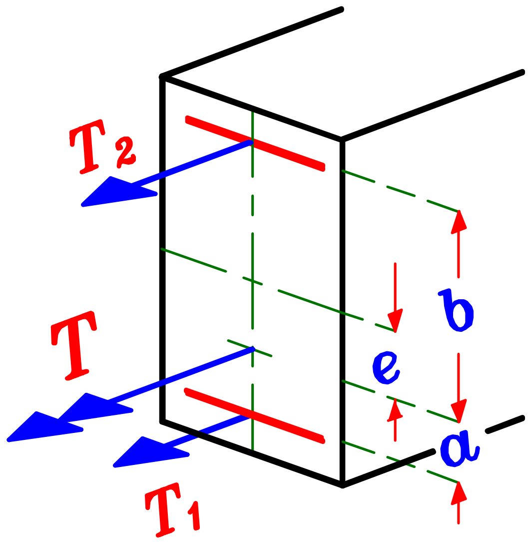
Because $\frac{e}{t} \simeq 0.1 < 0.5 \longrightarrow$ المحصله تكون داخل القطاع
و تكون الخرسانه مشرخه من الجهتين
و يقاوم الحديد كل ال Tension

$$\boxed{a = \frac{t}{2} - c - e}$$

a هى بعد المحصله عن الحديد الاقرب لها

$$\boxed{b = \frac{t}{2} - c + e}$$

b هى بعد المحصله عن الحديد الابعد عنها

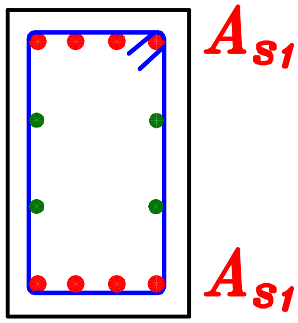


ملحوظه لان اتجاه ال moment غير معلوم لذا نصمم على اى اتجاه و نضع الحديد الاكبر فى الاتجاهين أى نصمم على قيمه T_1 و نضع تسليحها فى الاتجاهين .

By taking moment about T_2

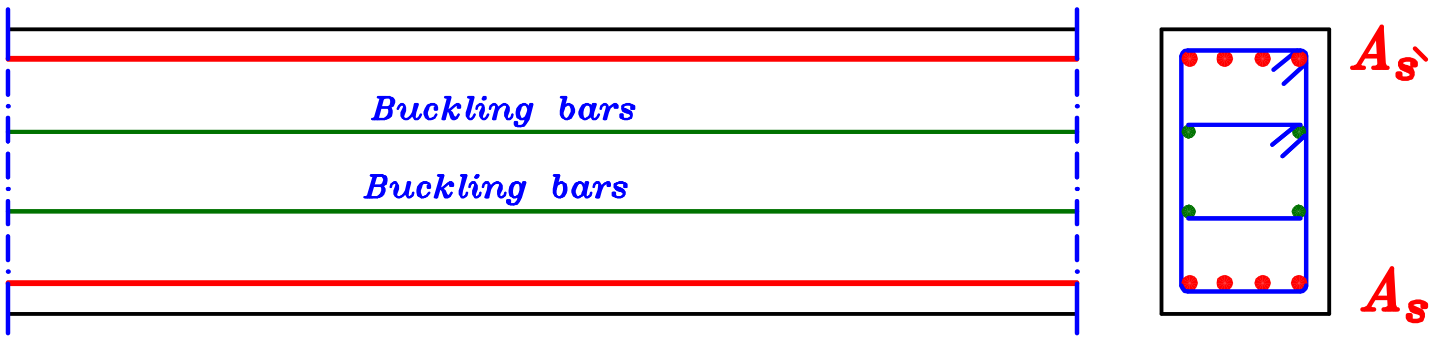
$$T_1 (a+b) = T (b) \longrightarrow \boxed{T_1 = \frac{b}{a+b} * T}$$

$$\boxed{A_{s1} = \frac{T_1}{(F_y/\gamma_s)}}$$



Reinforcement of Truss.

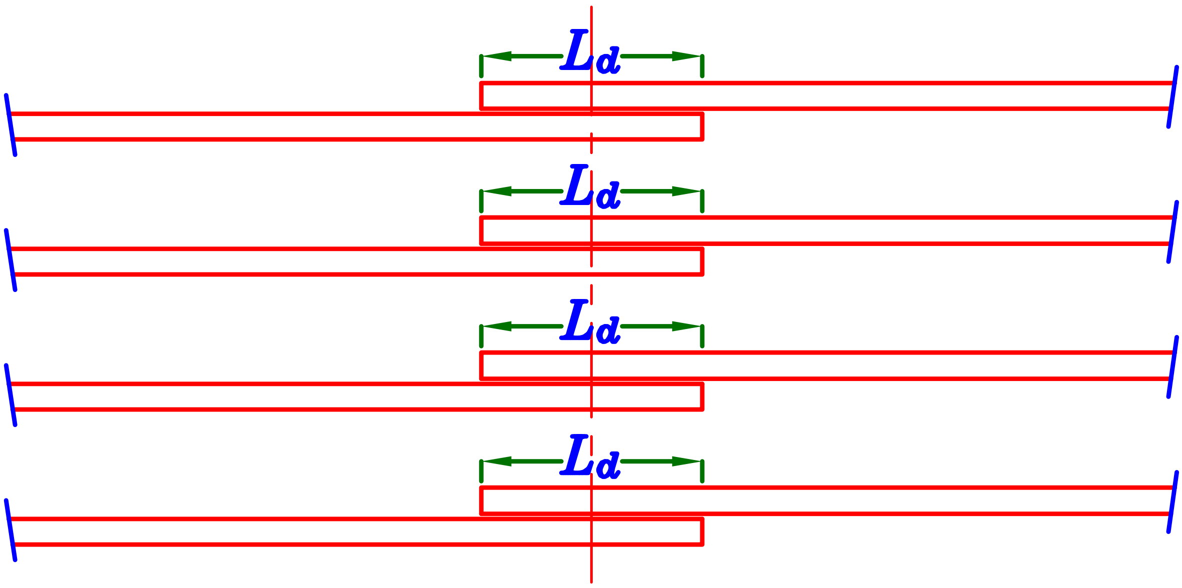
1- For Compression members.



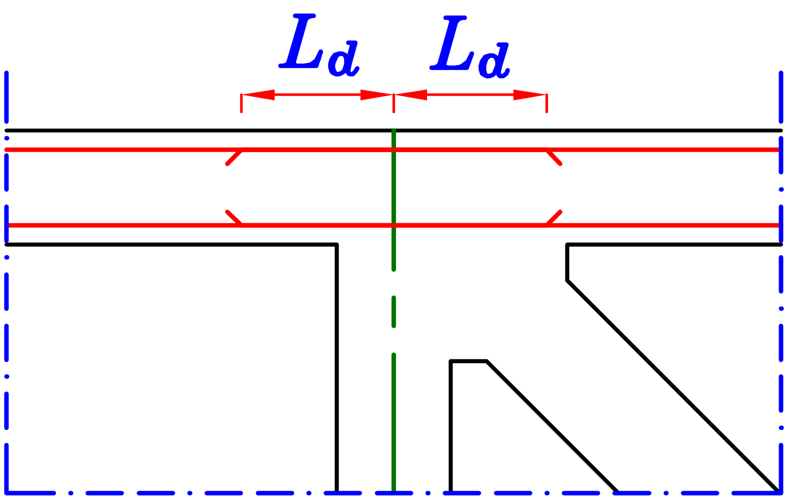
و اذا زاد طول السيخ عن ١٢,– م نعمل وصله تراكب **Lap splice**

$$\boxed{L_d = 40\,\phi}$$

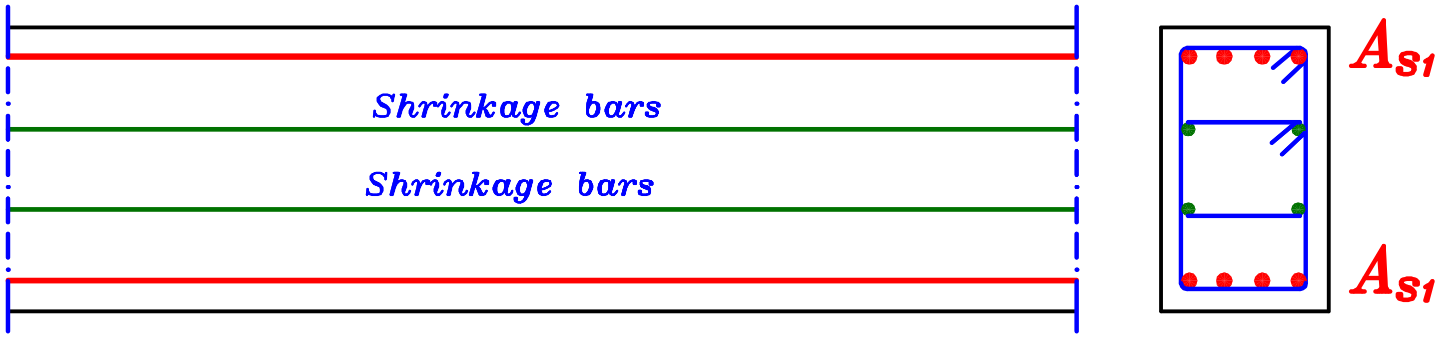
ممكن عمل كل الوصلات فى قطاع واحد .



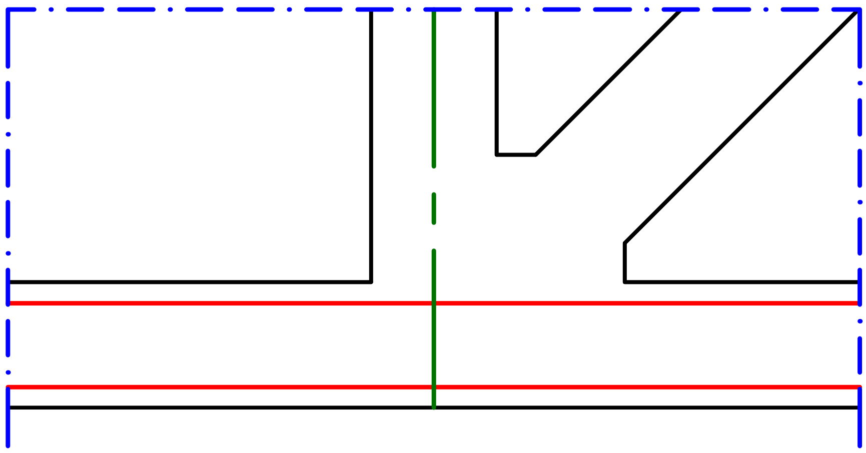
و الاضمن مد الحديد مسافه L_d من بعد الـ C.L. من الجهتين

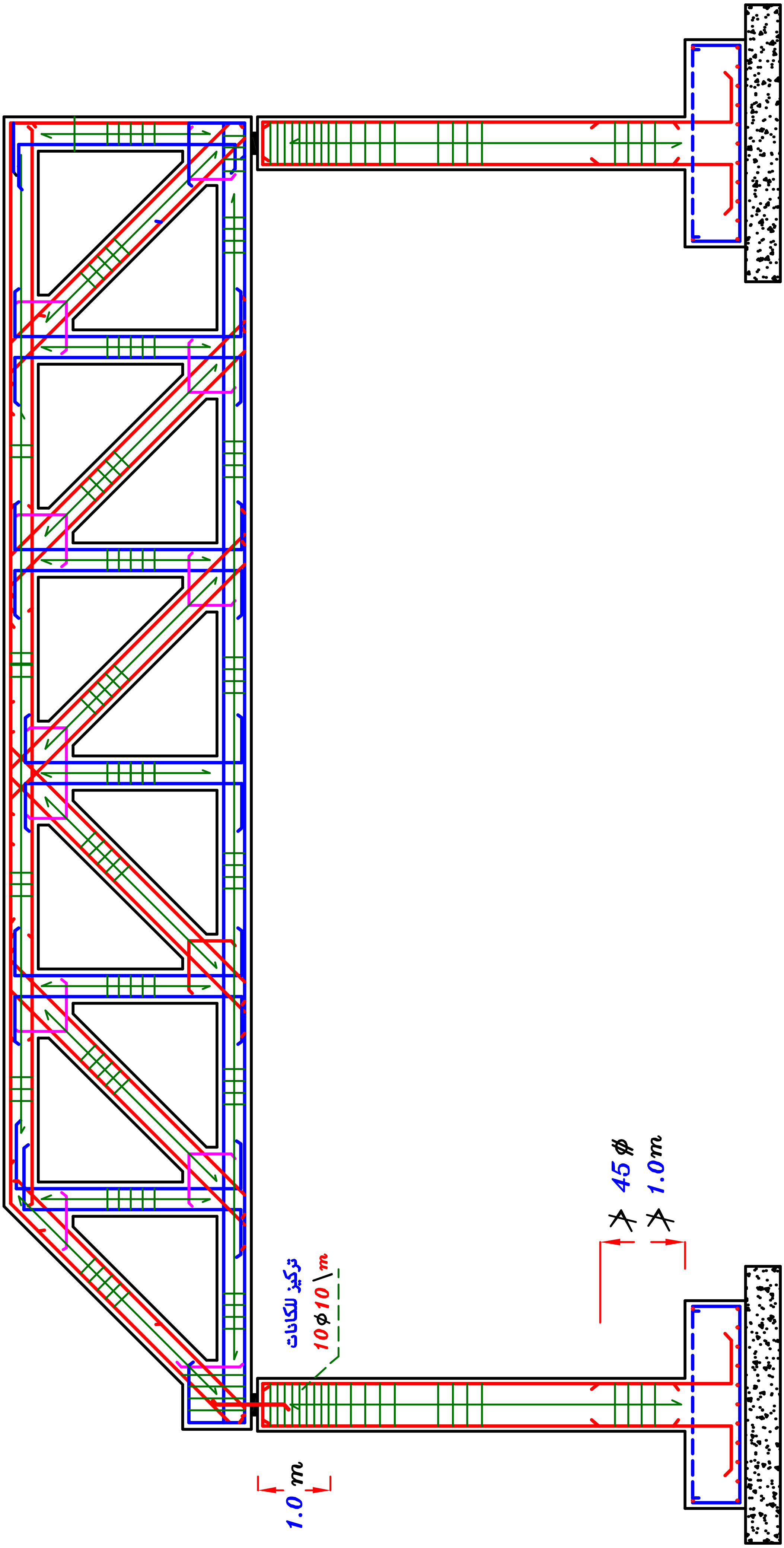


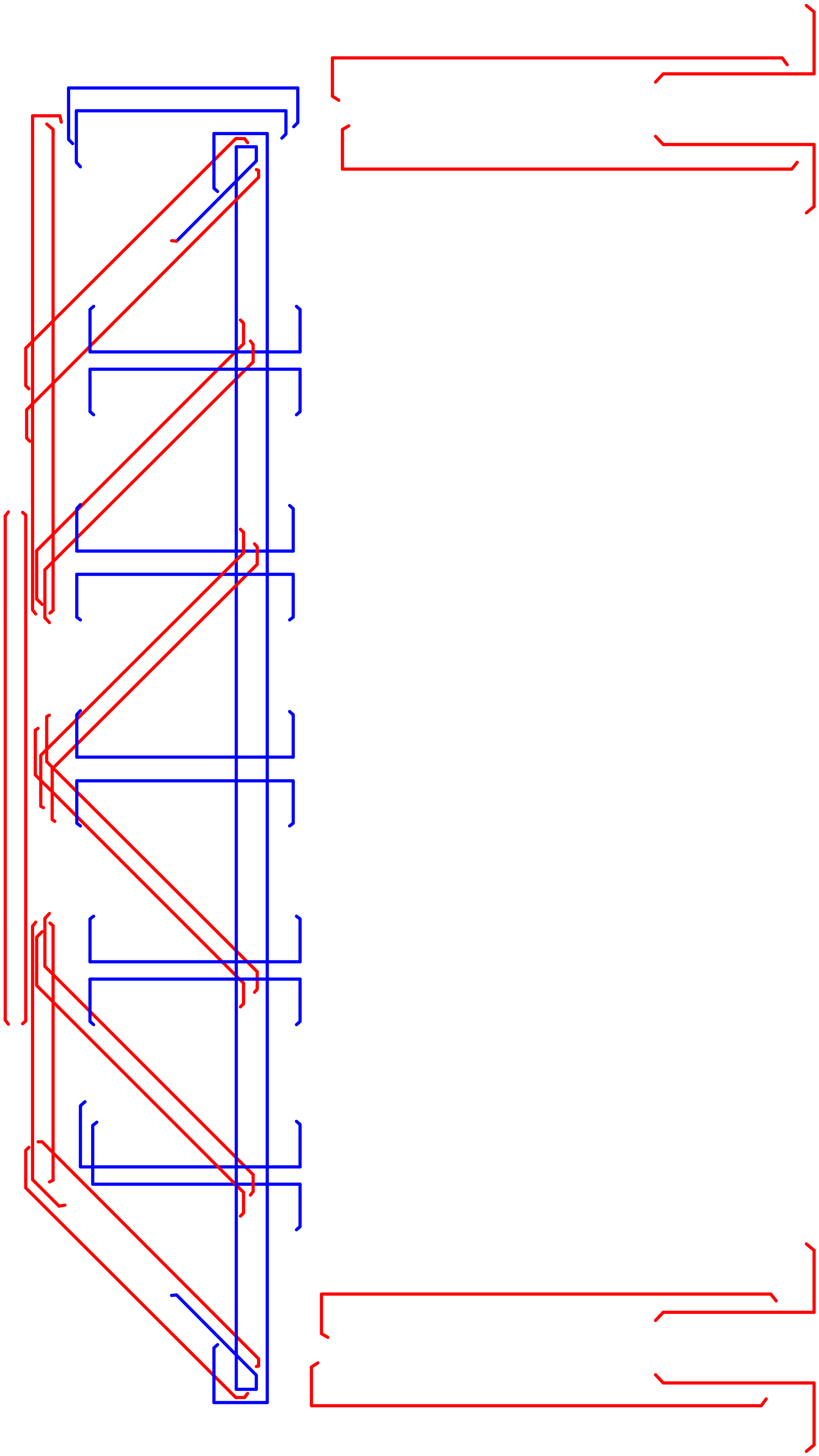
2-For Tension members.

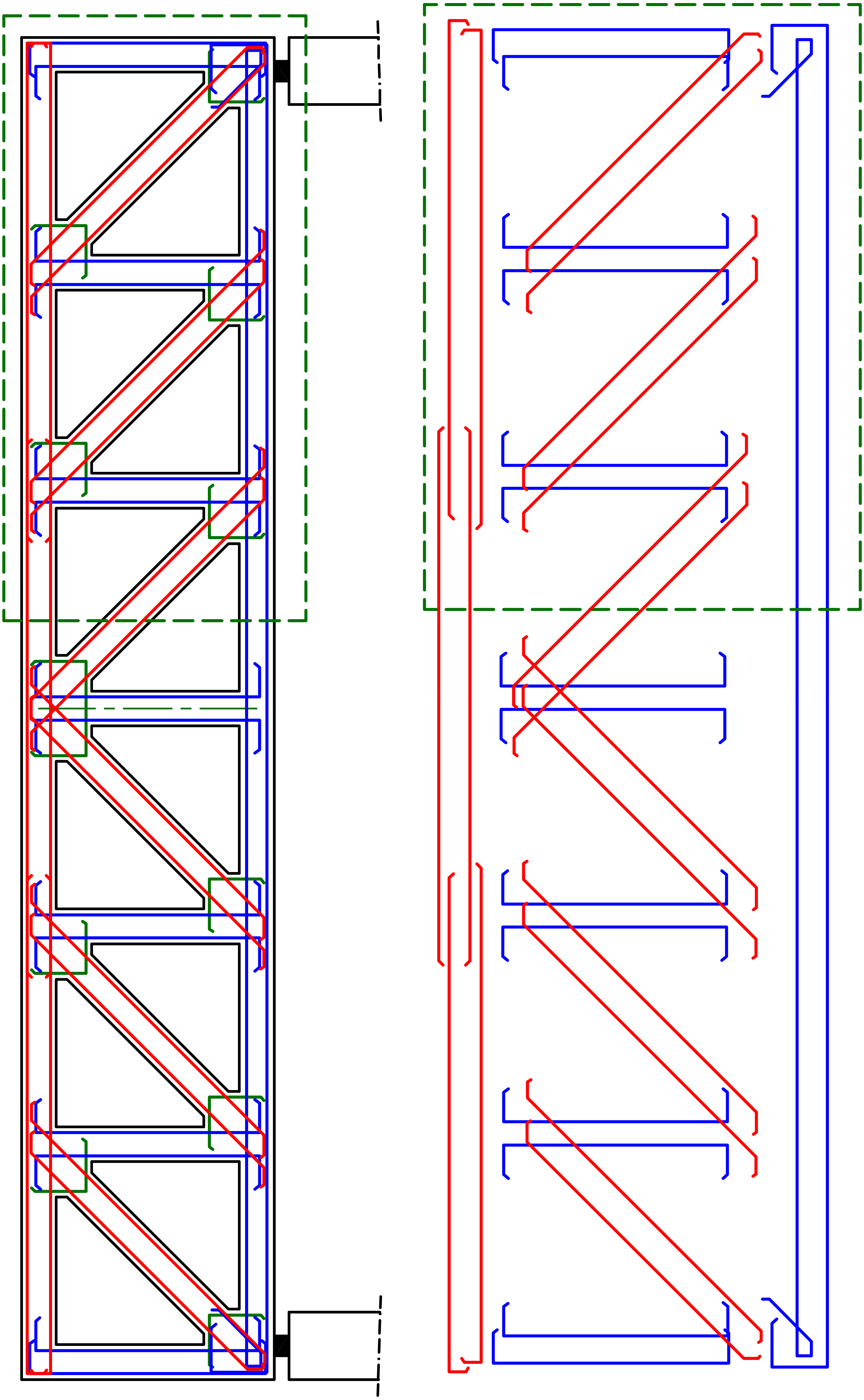


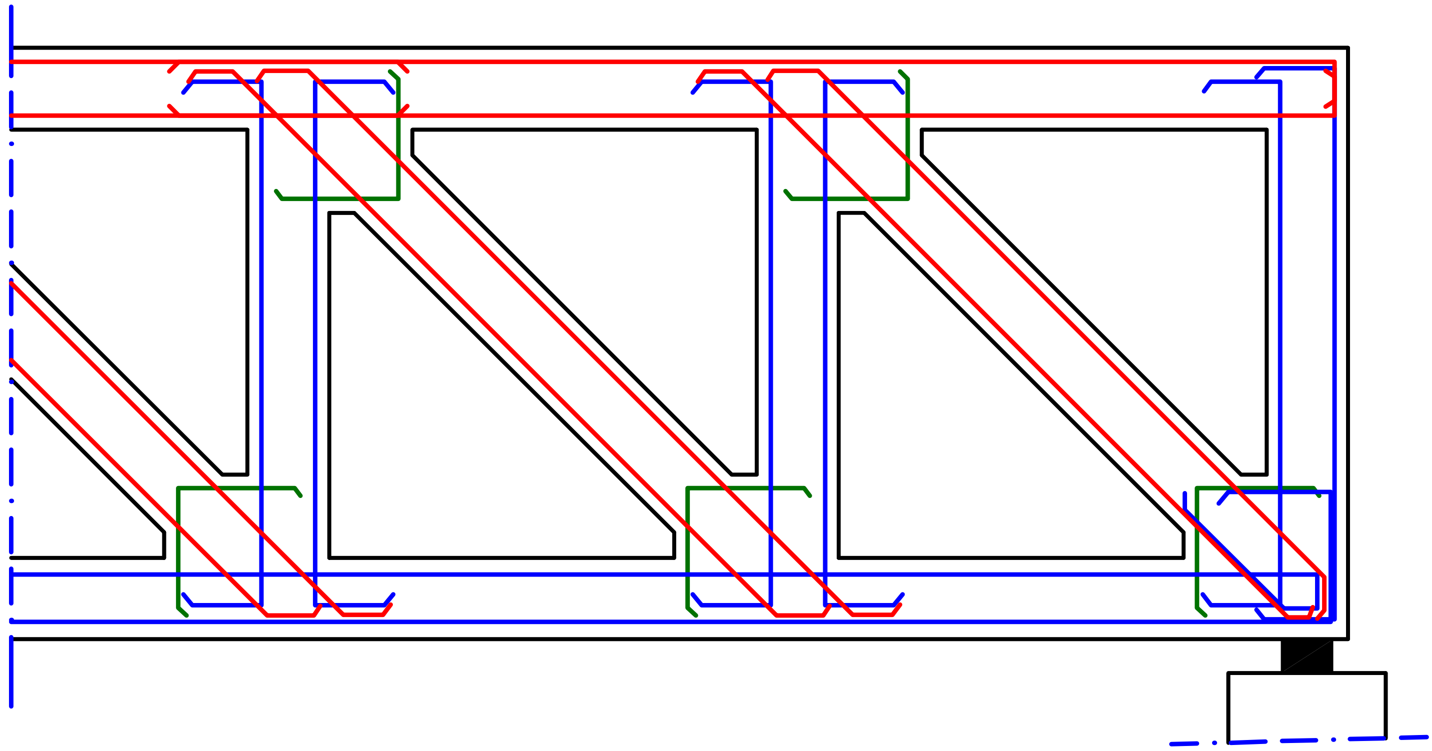
و اذا زاد طول السيخ عن - ١٢, م المفروض عمل وصله ميكانيكيه او وصلات لحام و لصعوبه رسم تفاصيل ذلك في هذا الملف فسنضطر ان نرسم تسليح ال ***Tension member*** عباره عن اسياخ طويله بطول الجزء الواقع عليه ***Tension***

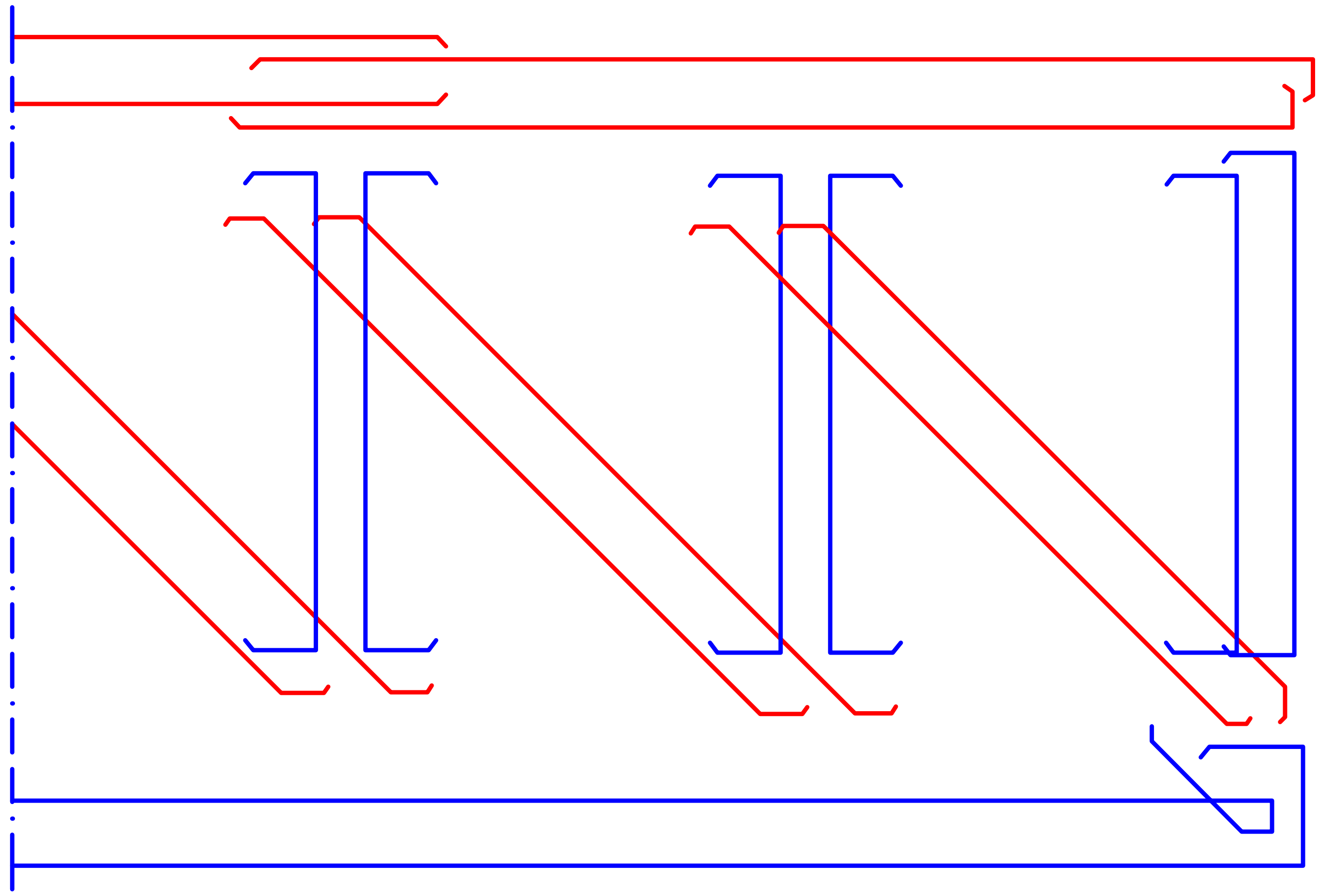



45 φ
1.0 m
تركيز للكانات
10φ10\m
1.0 m



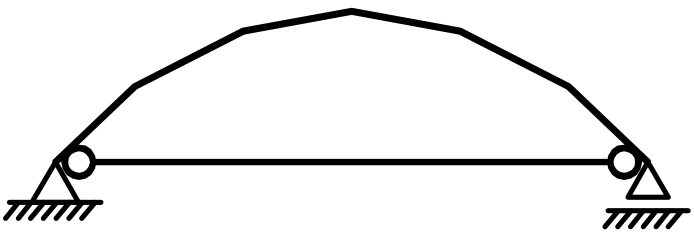


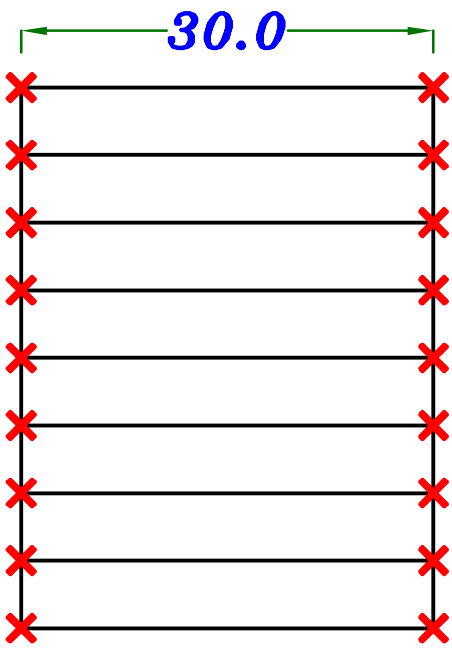




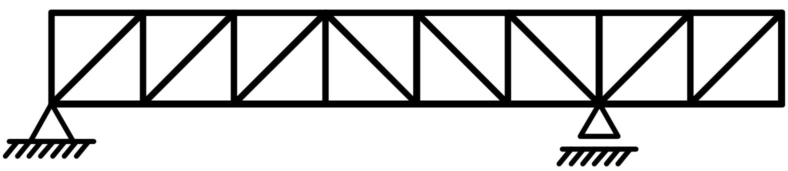
Note.

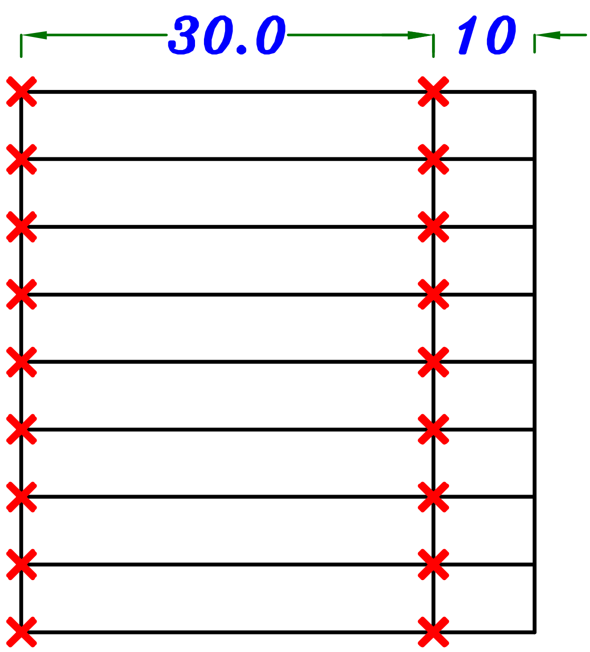
اذا كان بحر ال *system* أكبر من ٢٤ م
و كان ال *system* عباره عن *simple*
يفضل أن يؤخذ *Arch Girder*



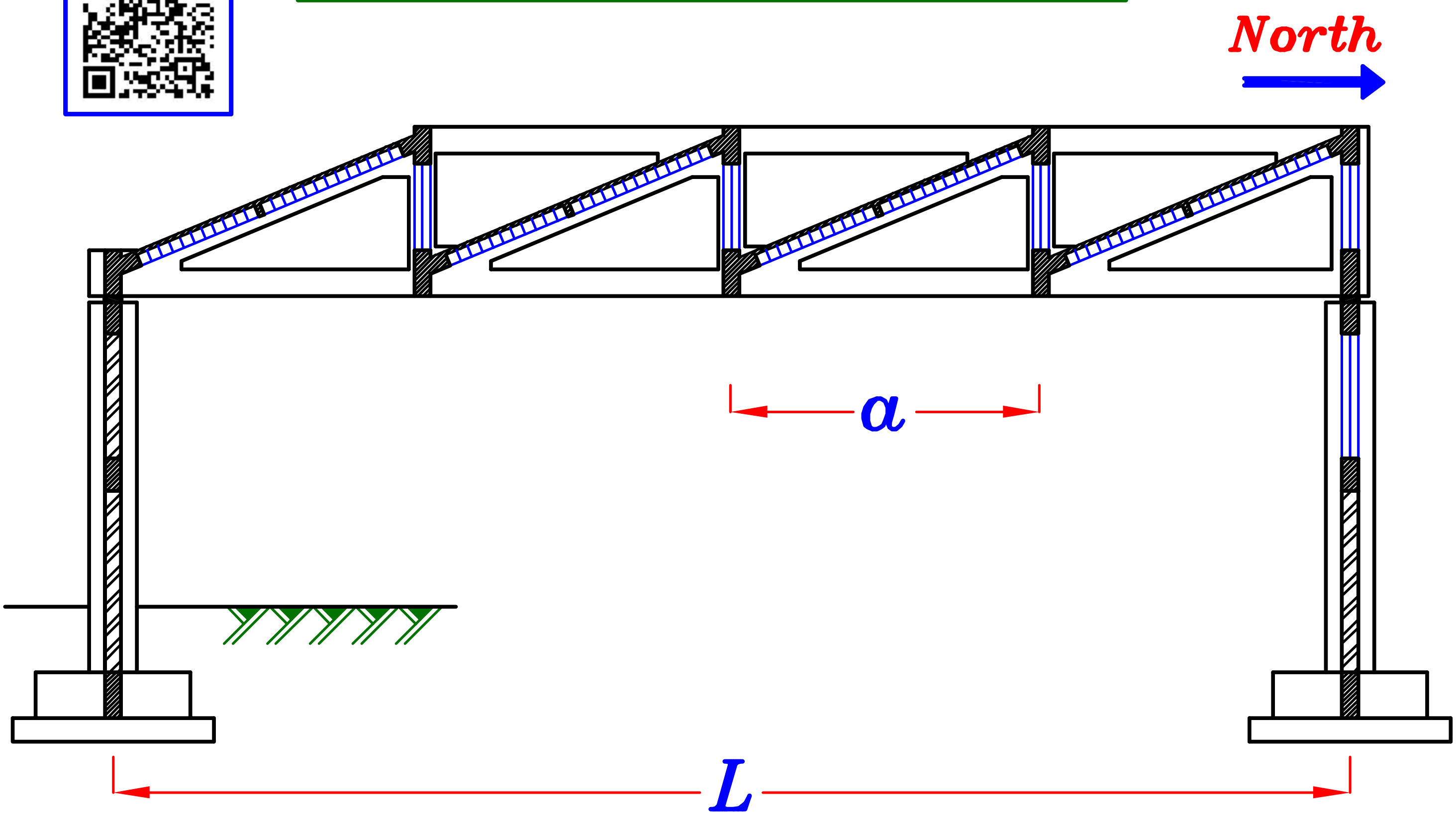


اذا كان بحر ال *system* أكبر من ٢٤ م
و كان ال *system* عباره عن
Beam with cantilever
يجب أن يؤخذ *Truss*



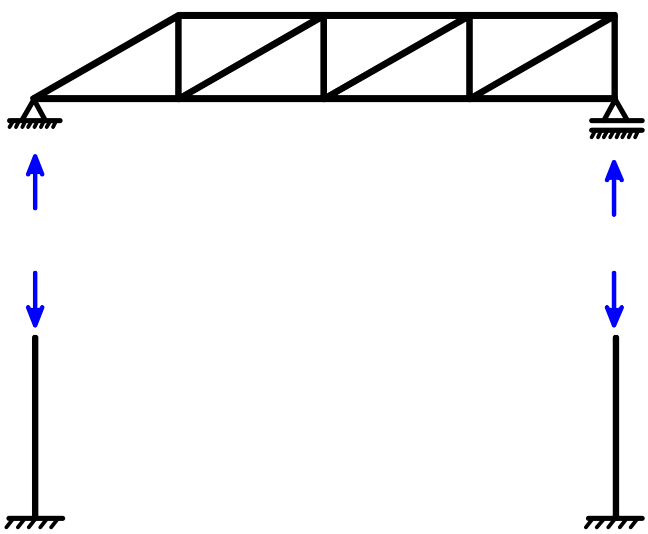


Saw Tooth on Truss



الشباك يجب أن عمودى على الـ Truss
ممكن أن يكون الشباك مائل .

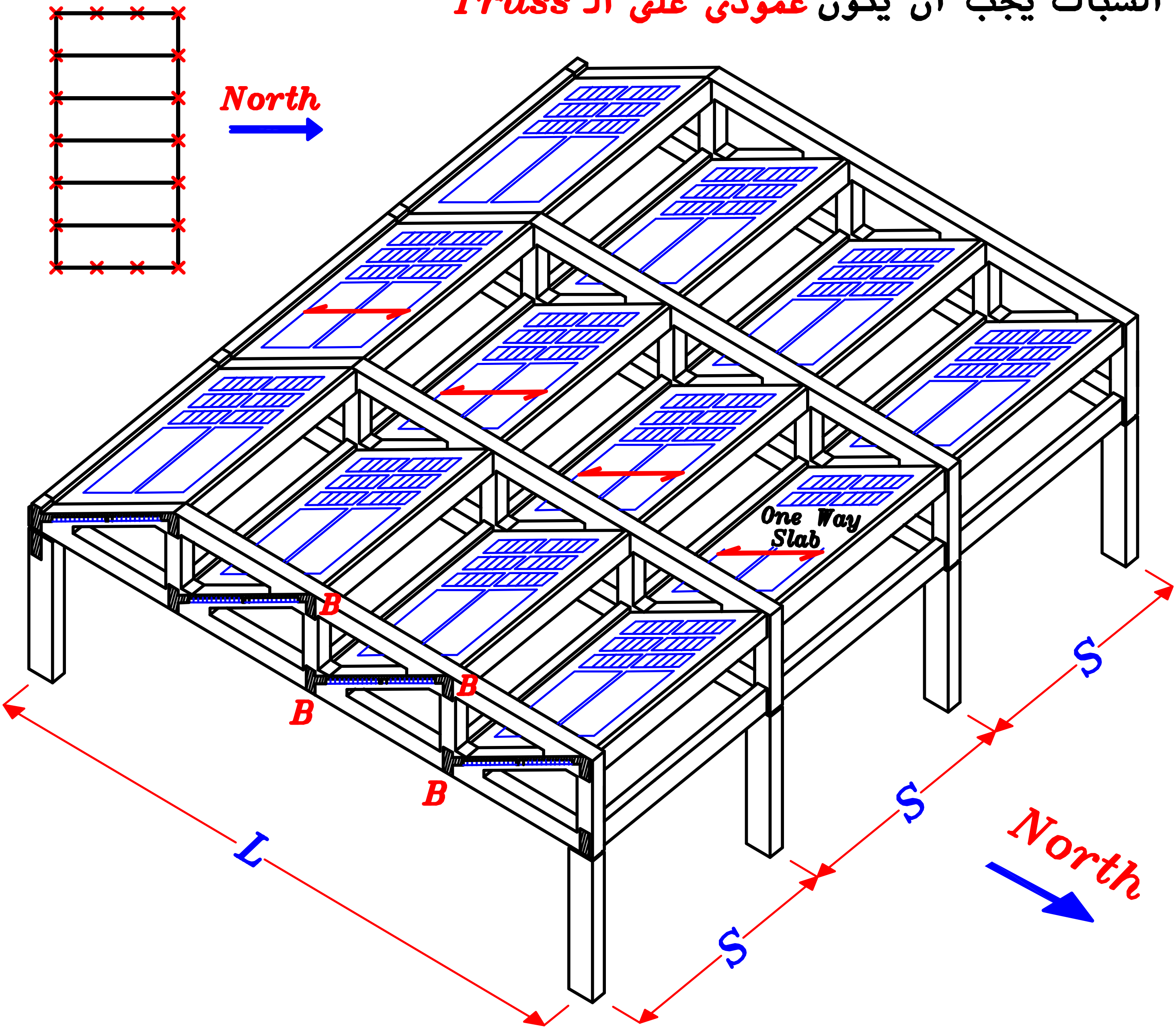
* Span $(L) = (15 \rightarrow 40)\ m$
* Height $(h) = \dfrac{L}{6 \rightarrow 8}$
* t (Compression members) $\simeq \dfrac{L}{40}$
* t (Tension members) $\simeq \dfrac{L}{50}$
* $b = \left. \begin{matrix} 0.30\ m \\ \dfrac{Spacing}{20} \end{matrix} \right\}$ الأكبر
* $t_{col.} = \dfrac{H}{8 \rightarrow 9}$

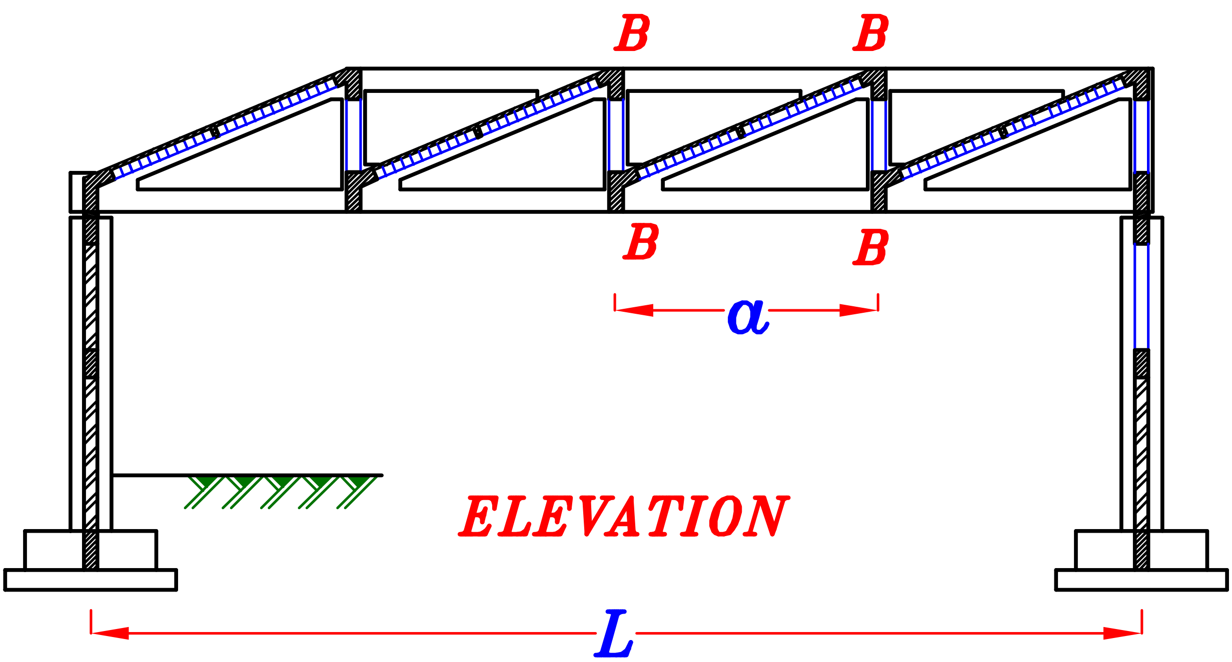


Statical System

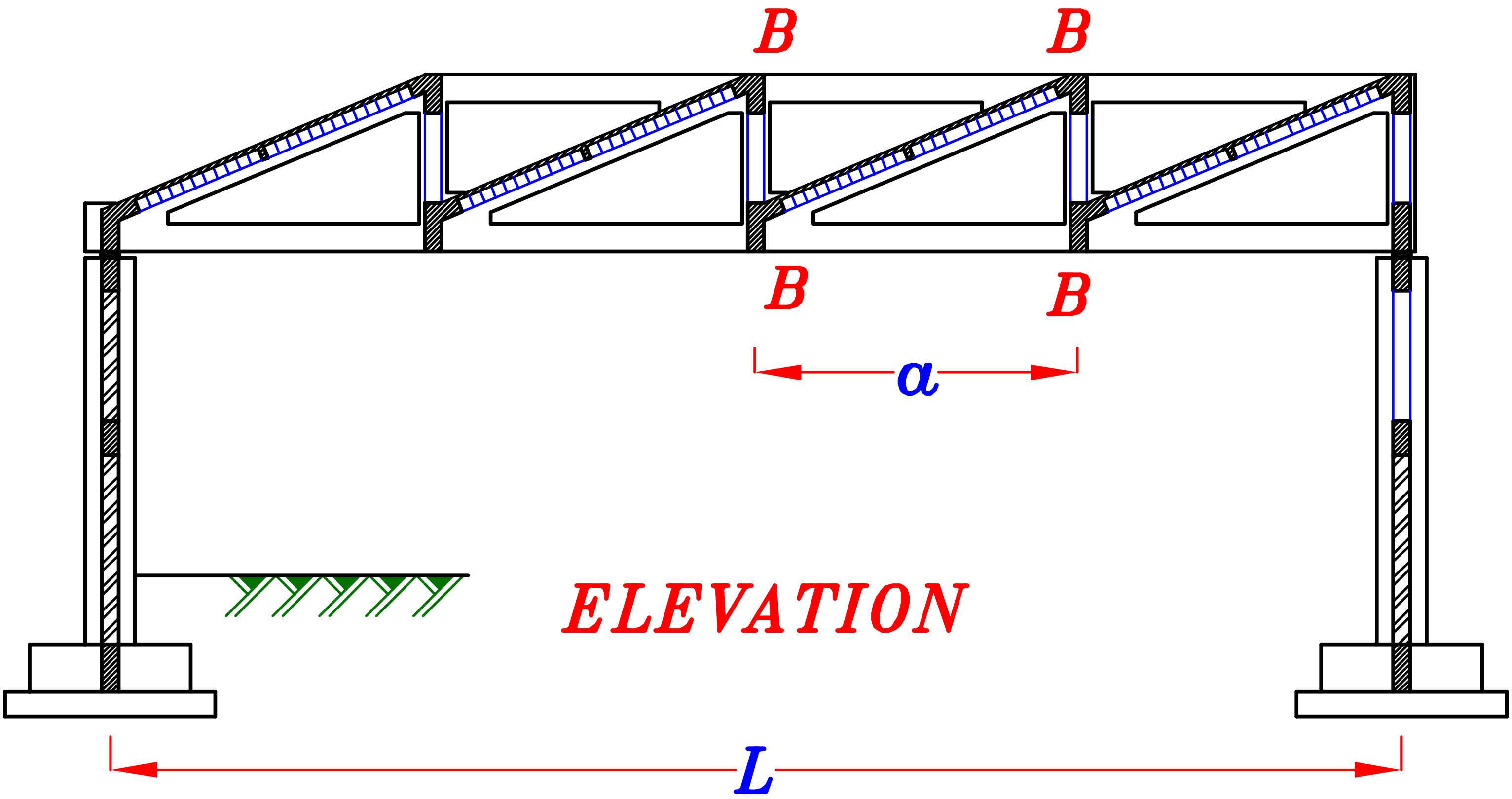
Saw Tooth Slab Rested on Truss

الشباك يجب أن يكون عمودى على ال Truss

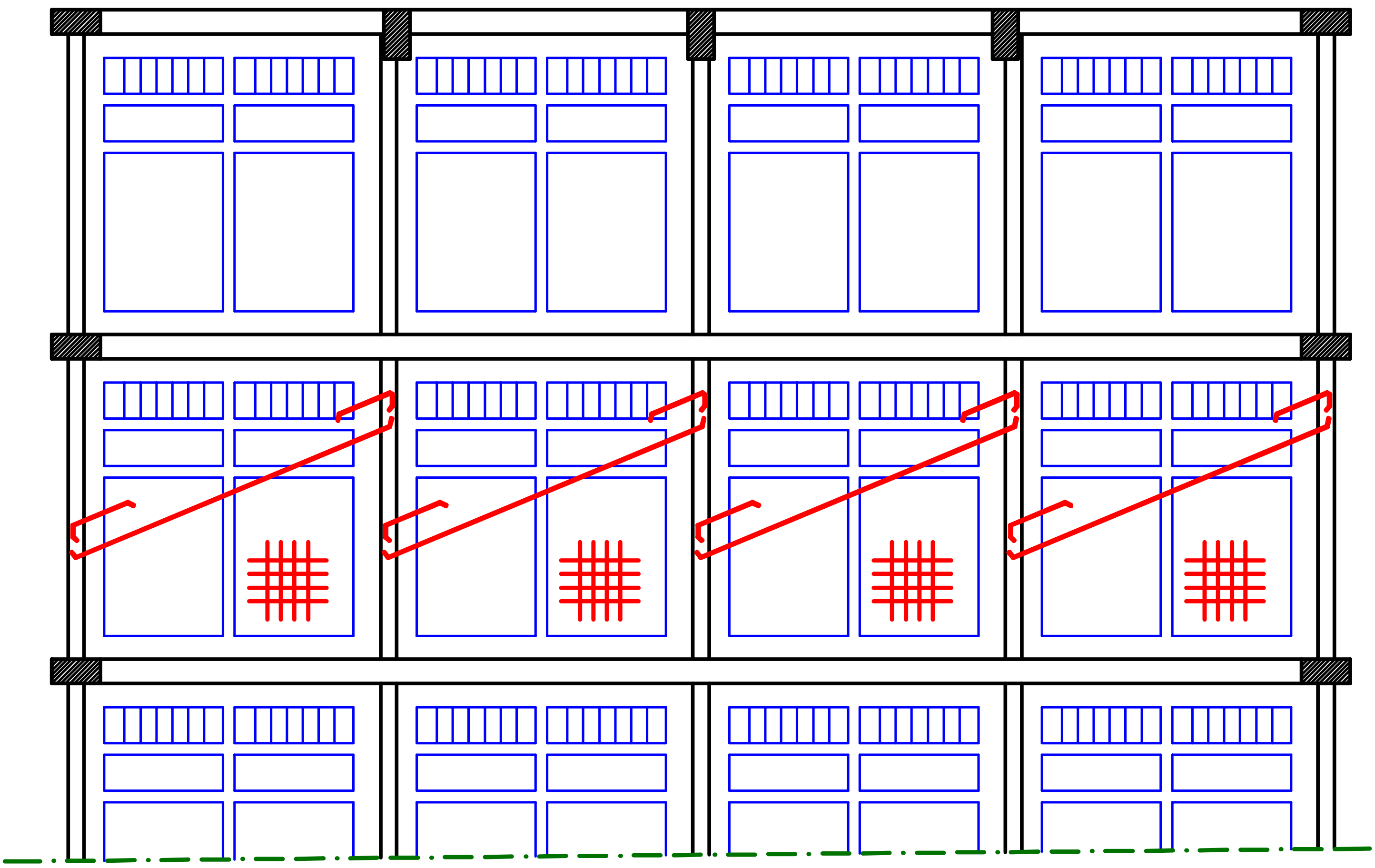




ELEVATION



ELEVATION

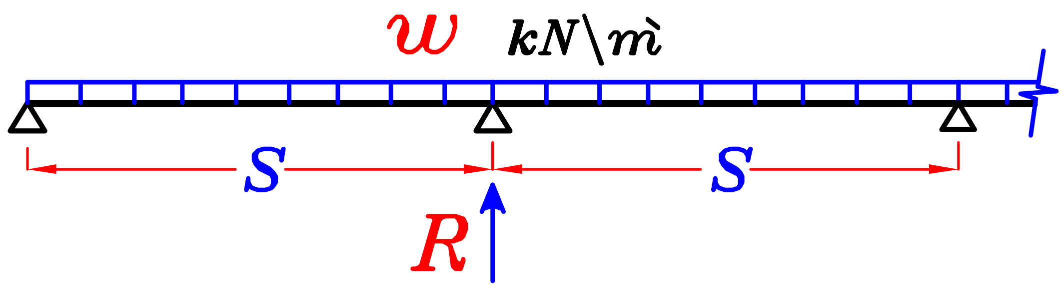


PLAN

* Loads on Beam B

$$w = o.w. + \frac{w_{rib}}{S} * \frac{a`}{2}$$

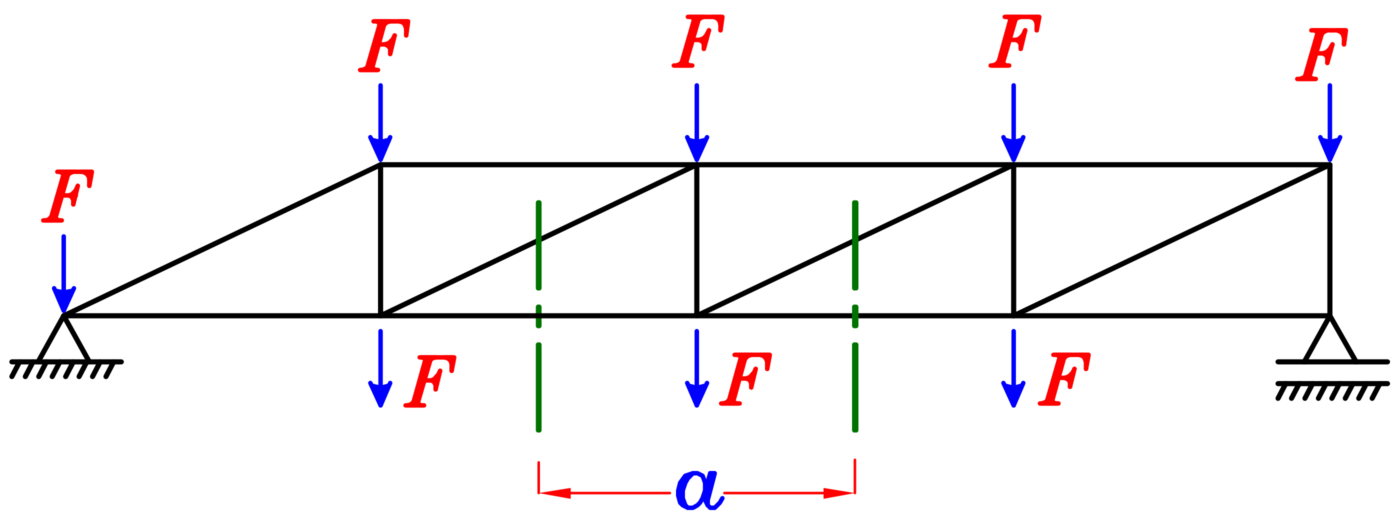
$$R = w * S$$



* Loads on The Truss.

$O.W._{(Truss)} \simeq 17.5$ kN\m` (U.L.)

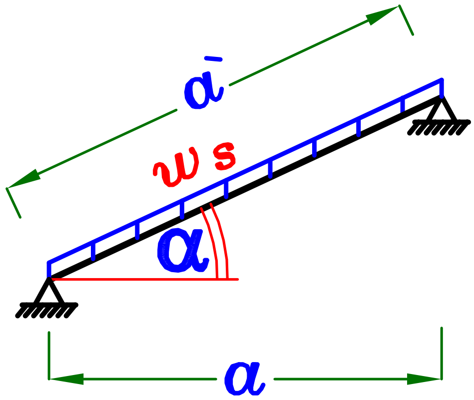
$$F = \frac{o.w. * a}{2} + R = \checkmark \text{ kN}$$



* Loads From Slab.

Get w_{rib}

$$w_s = \frac{w_{rib}}{s}$$

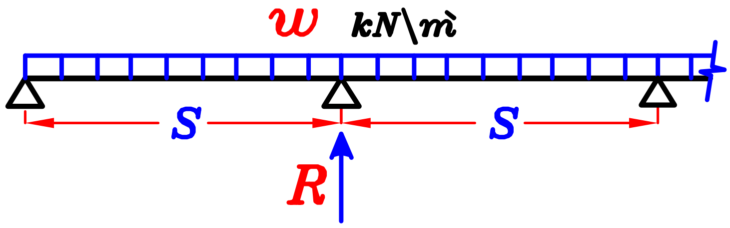


Strip in the slab.

* Loads on Beam B

$$w = o.w. + \left(\frac{w_{rib}}{s}\right) * \frac{a`}{2}$$

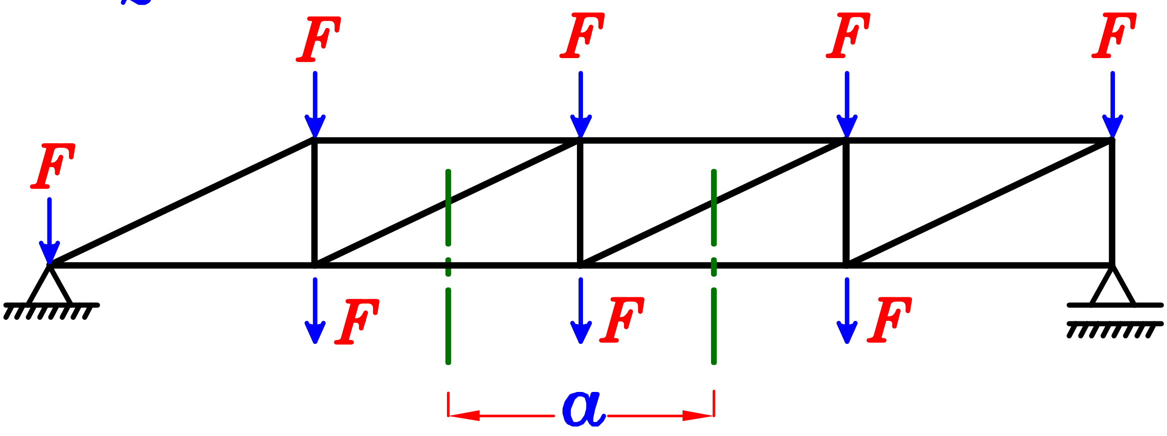
$$R = w * S$$

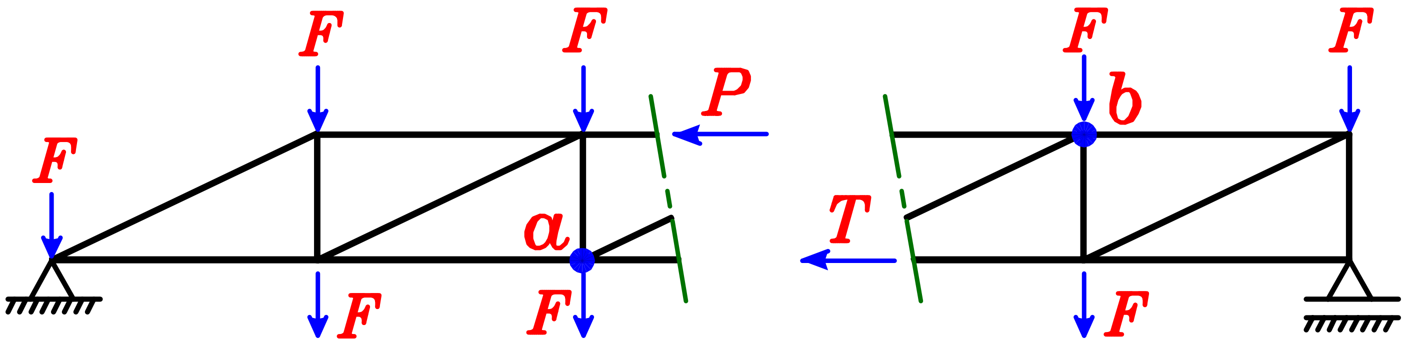


* Loads on The Truss.

$O.W.$ (Truss+Tie+Post+Hanger+Top beam) $\simeq$ 17.5 kN\m` (U.L.)

$$F = \frac{o.w. * a}{2} + R = \checkmark \ kN$$

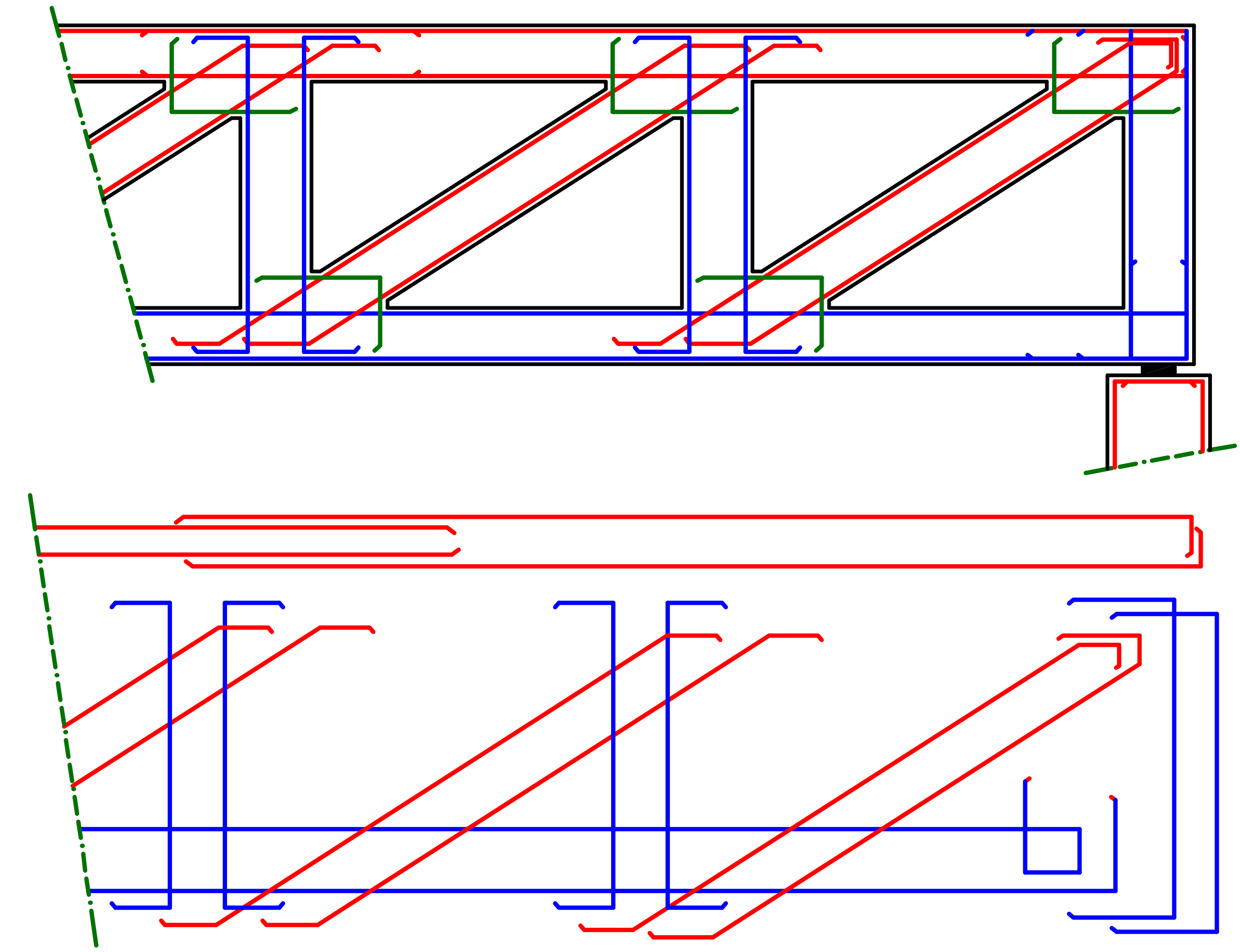




$\sum M$ at joint a = Zero $\xrightarrow{Get}$ P Comp. Force at member (1)

$\sum M$ at joint b = Zero $\xrightarrow{Get}$ T Ten. Force at member (2)

RFT. of Truss.

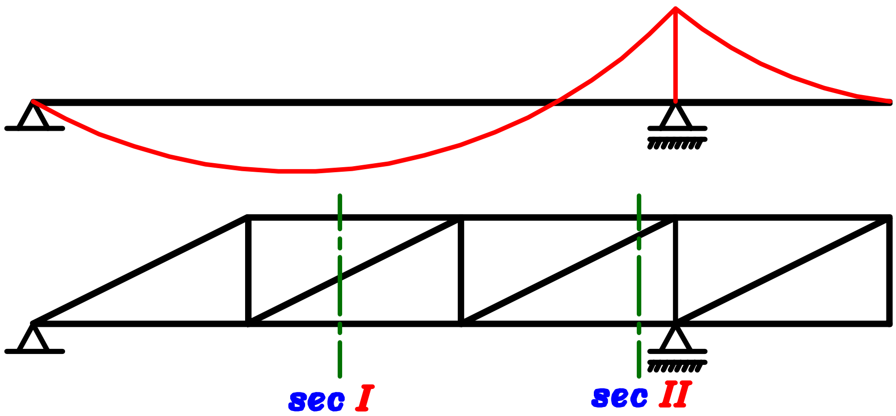


Special Case.

في حاله **truss with cantilever** المفروض أخذ **2 sections** عند أكبر **+Ve & −Ve**

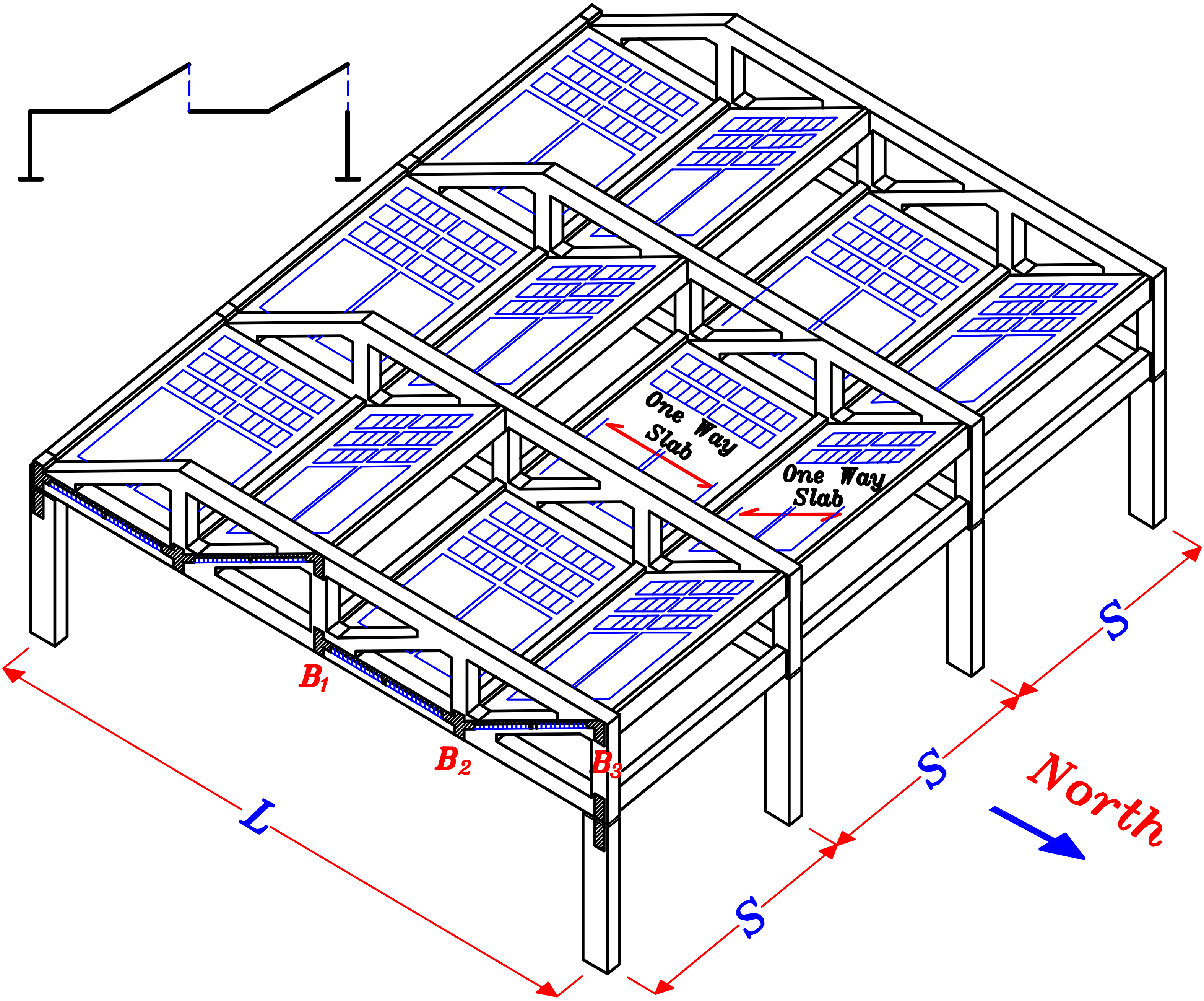
لمعرفه أكبر **Compression Force & Tension Force**

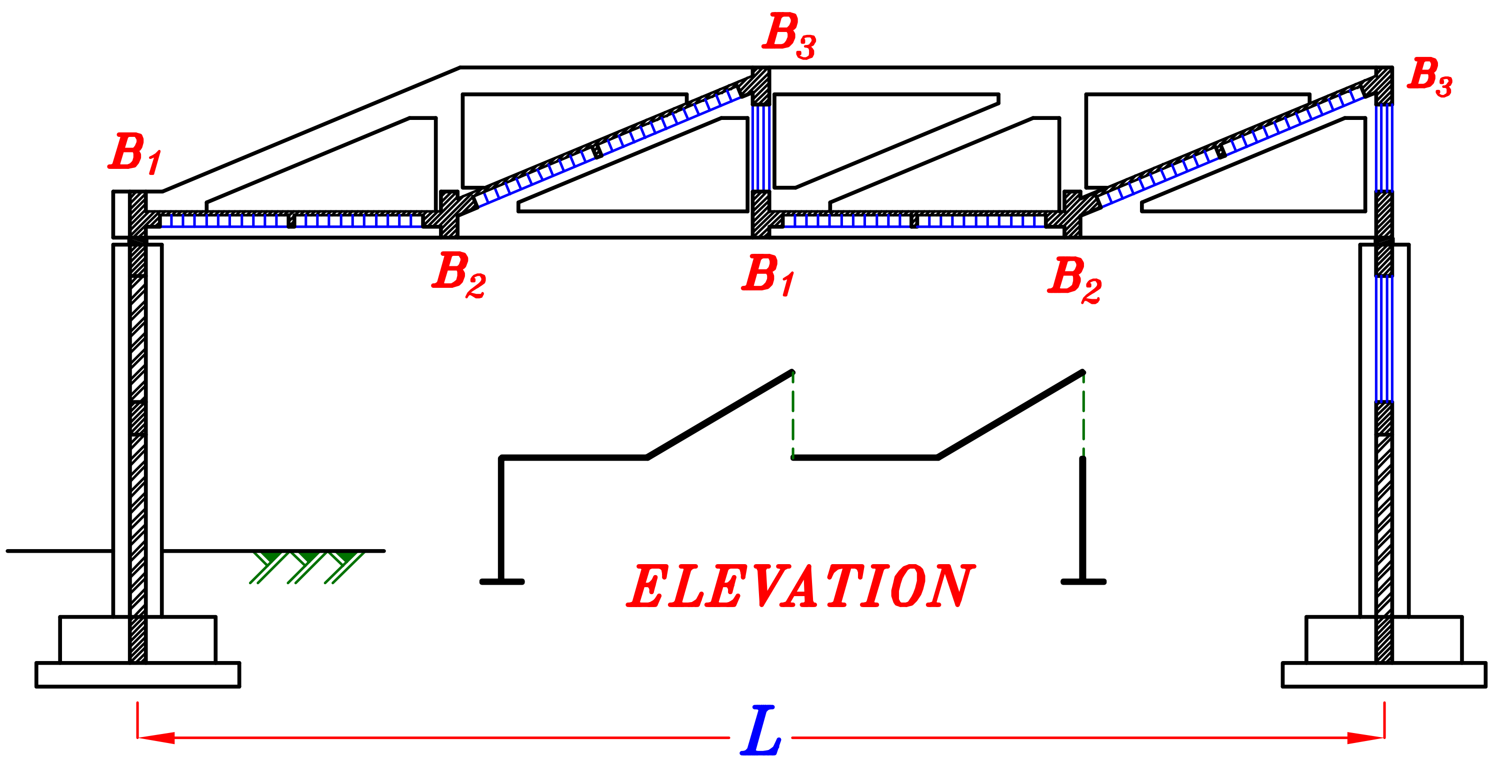
ثم نصمم قطاع عليه أكبر **Tension** و قطاع عليه أكبر **Compression**



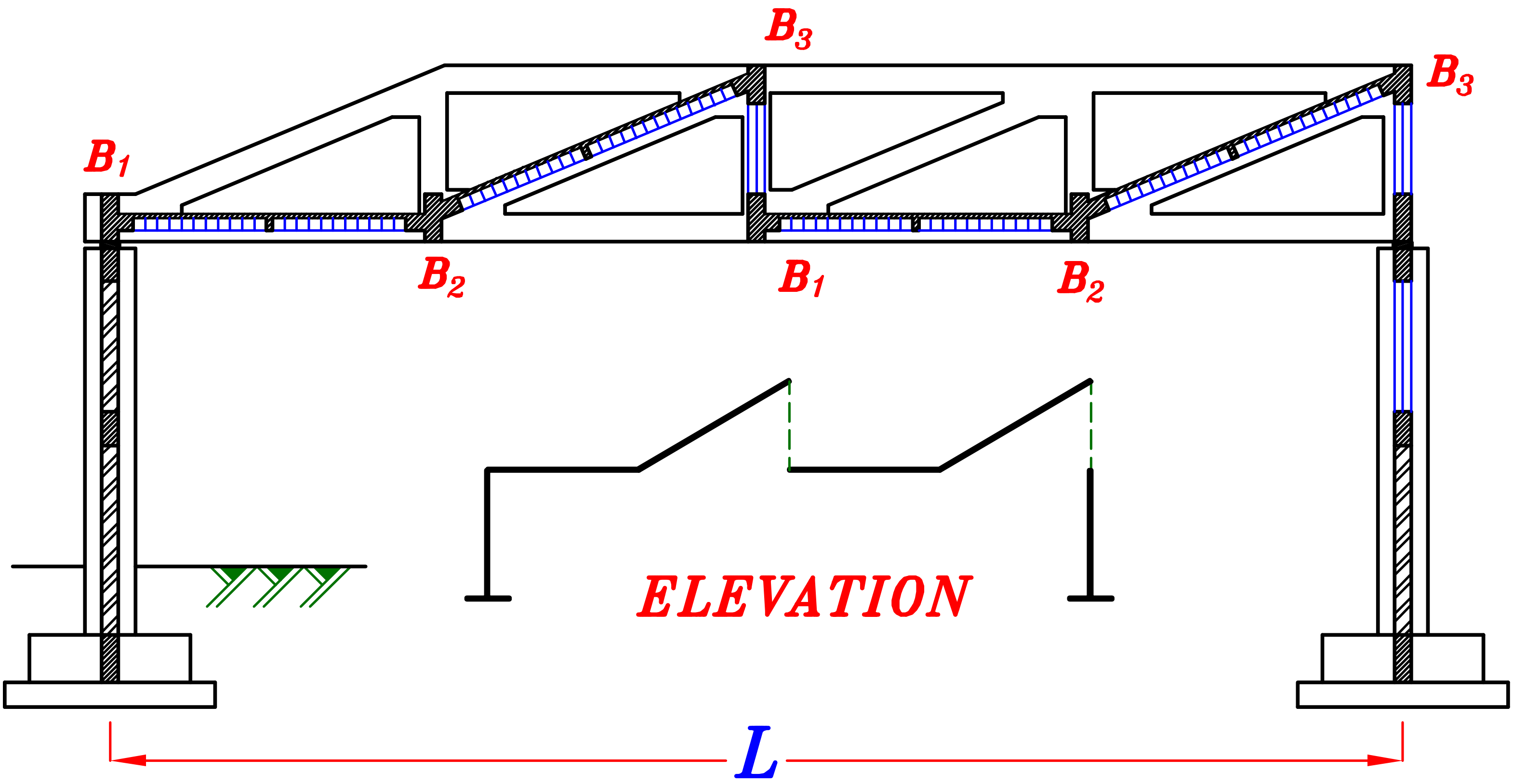
sec II من الممكن أن يكون **upper & Lower coards**

الاثنين **Tension** أو الاثنين **compression** أو واحد **Tension** و الاخر **compression**

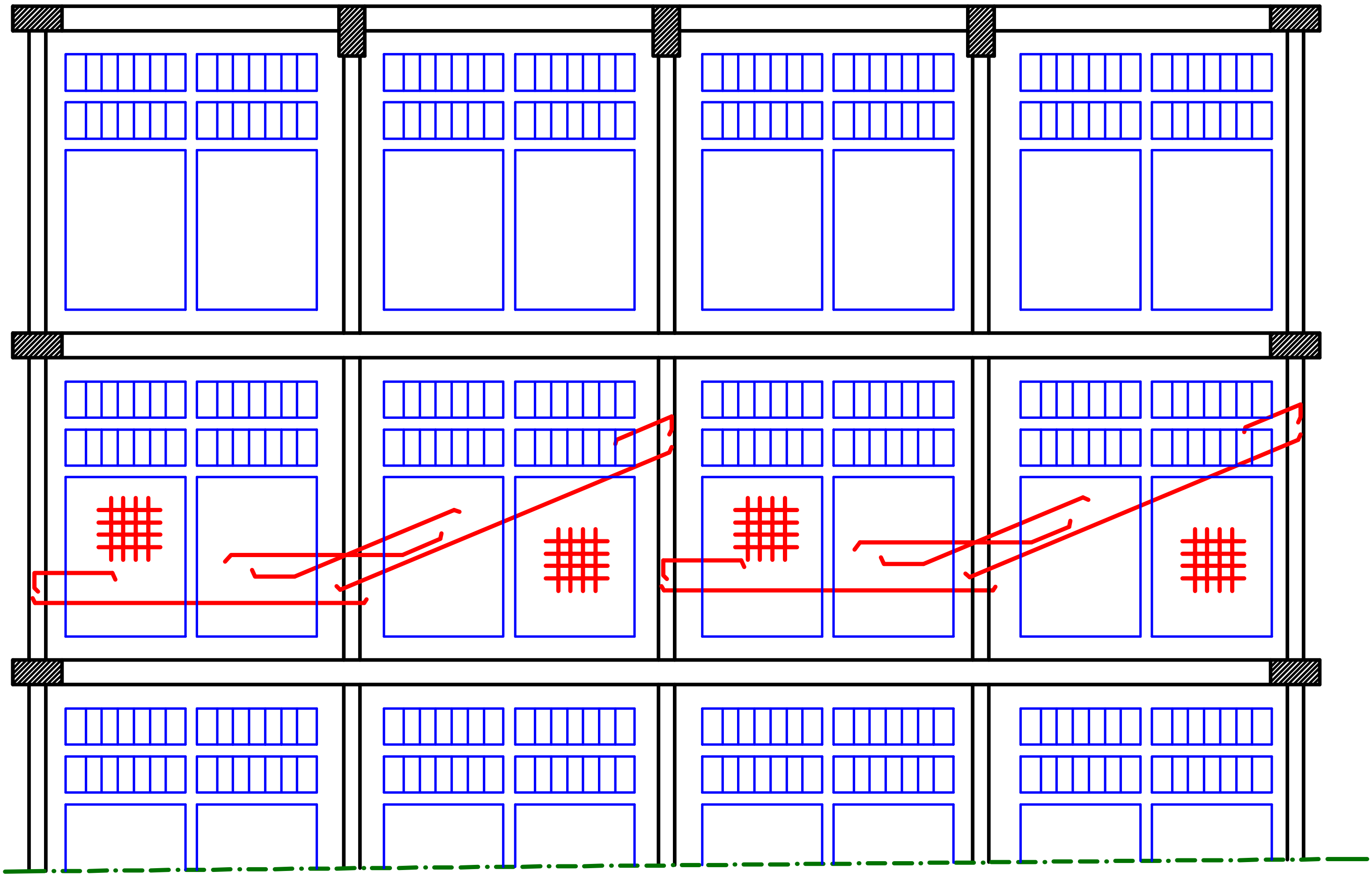




ELEVATION

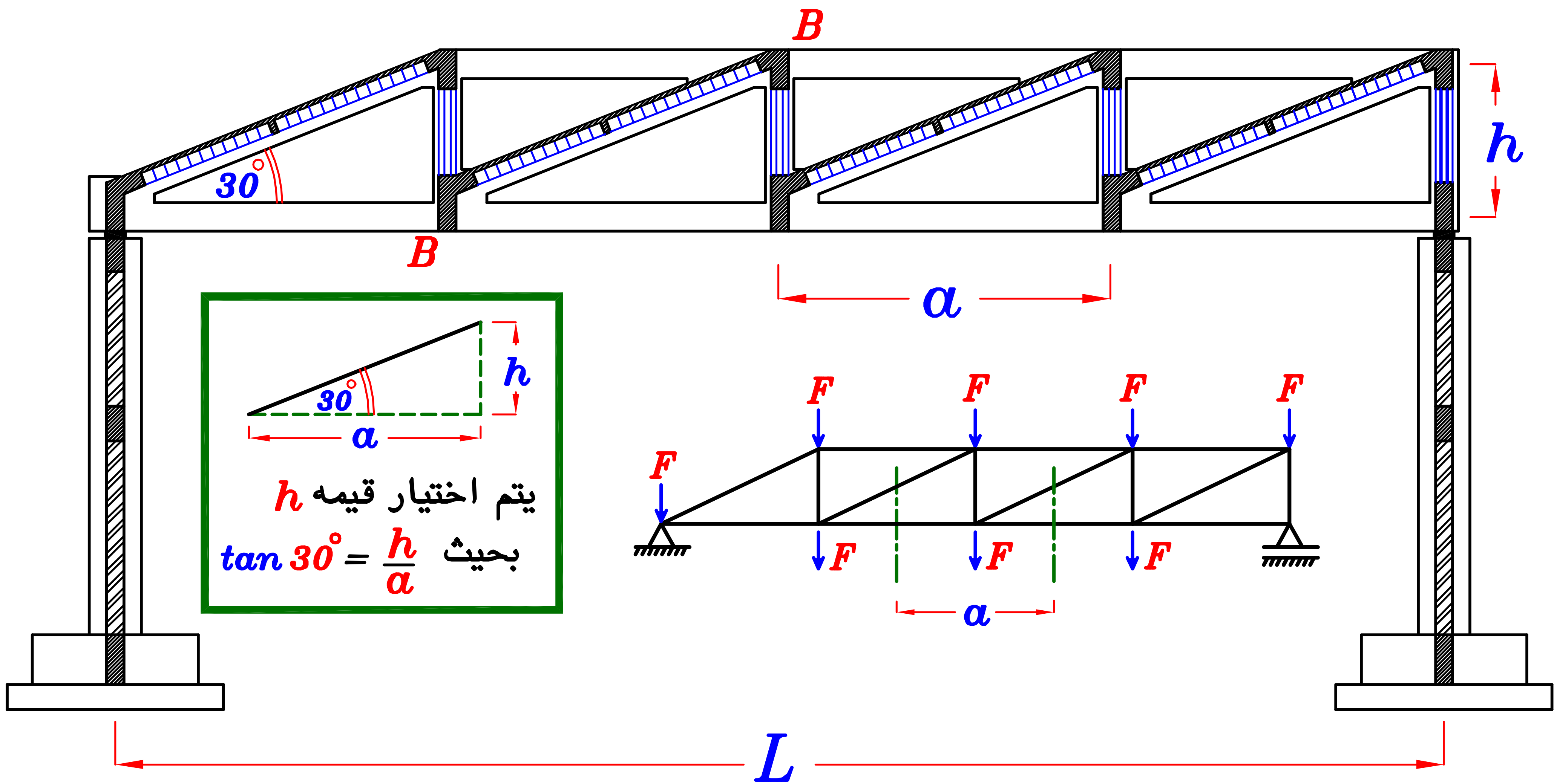


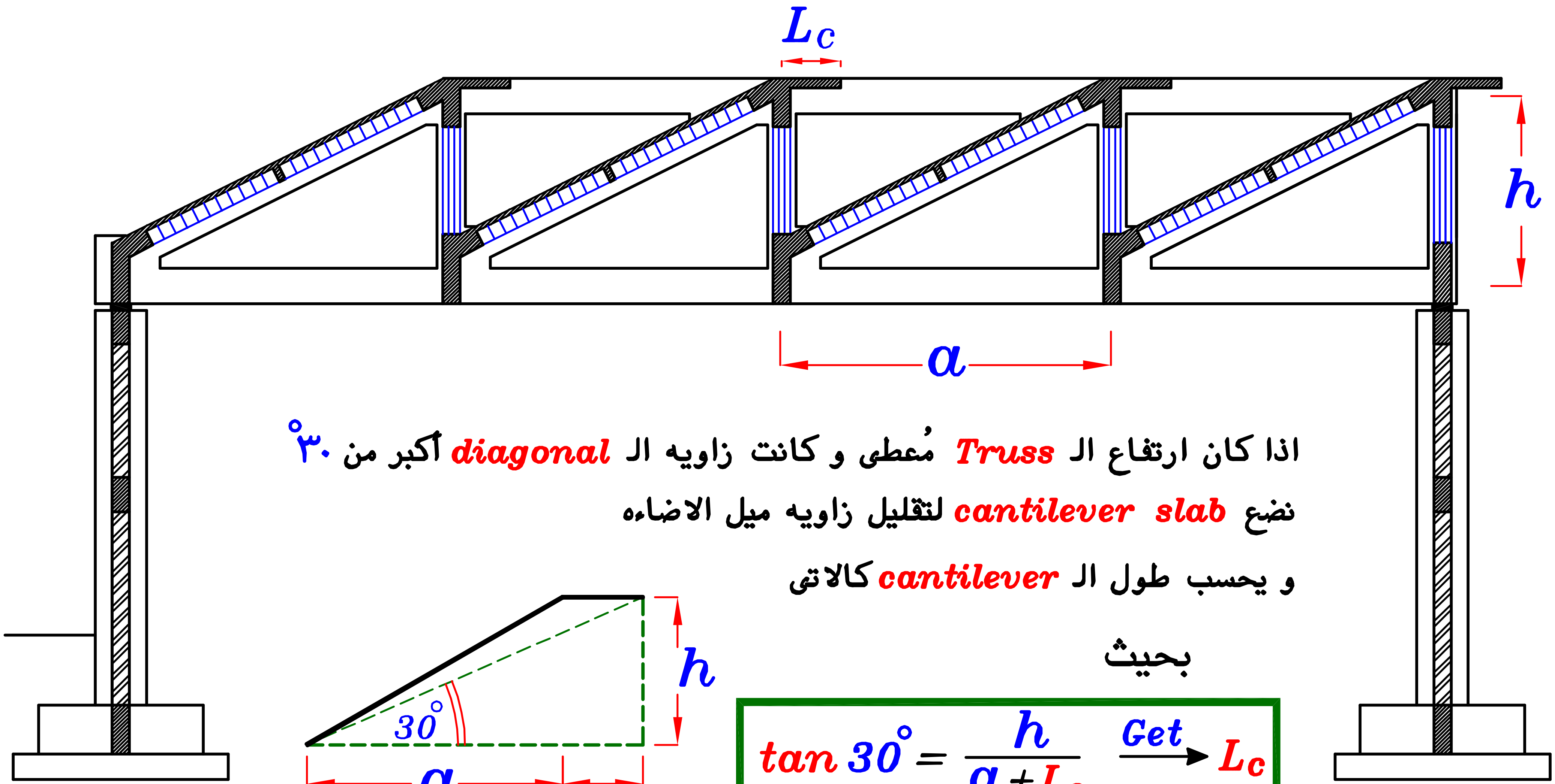
ELEVATION



PLAN

٣٠° Diagonals يفضل أن تكون زاويه ال Saw Tooth Truss





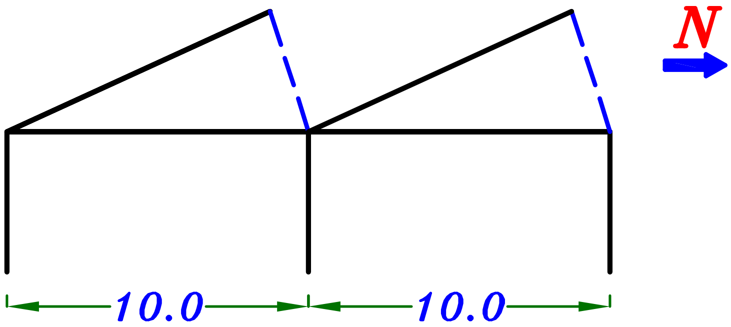
اذا كان ارتفاع ال **Truss** مُعطى و كانت زاويه ال **diagonal** أكبر من ٣٠°
نضع **slab cantilever** لتقليل زاويه ميل الاضاءه
و يحسب طول ال **cantilever** كالاتى

بحيث

$$\boxed{\tan 30^\circ = \frac{h}{a + L_c} \xrightarrow{Get} L_c}$$

Subdivided Truss

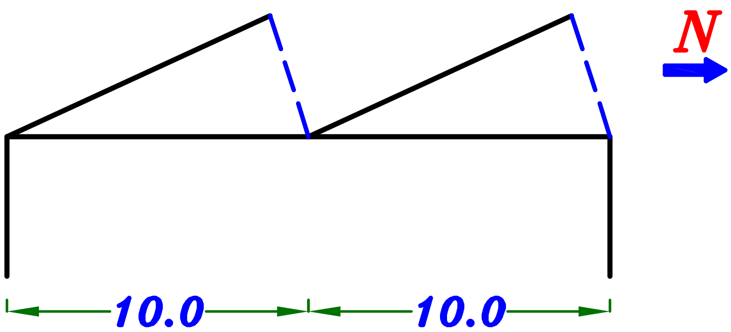
اذا كانت طول السنه أكبر من ٨٫٠ م عاده نأخذ **Saw Tooth Girder**



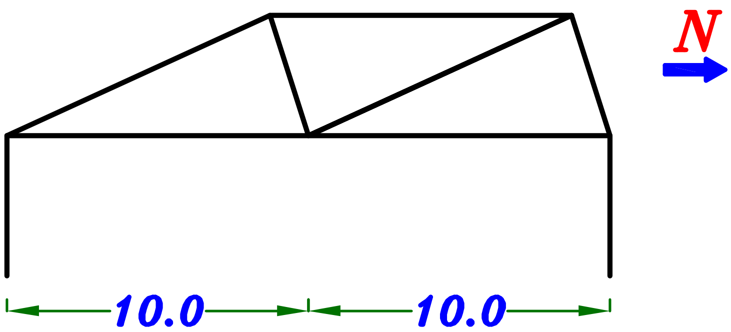
اذا تم ازاله العمود الاوسط لن نستطيع أن نجعلها **Saw Tooth on Frame**

لان ال **Frame** يستطيع ان يحمل **Saw Tooth slab type** فقط

و طول السنه في ال **Saw Tooth slab type** لا يزيد عن ٨٫٠ م

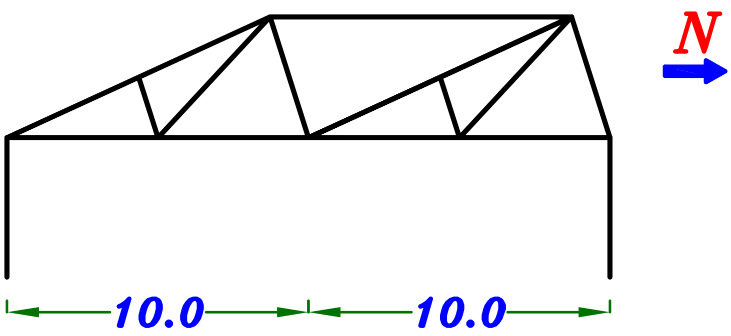


لذا يجب ان يكون ال **Saw Tooth** محمول على **Truss**

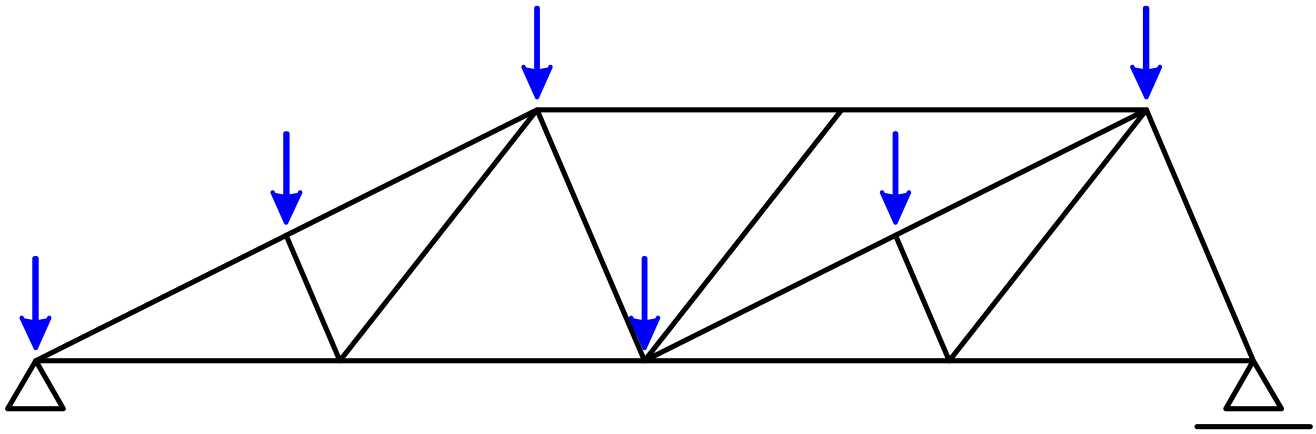


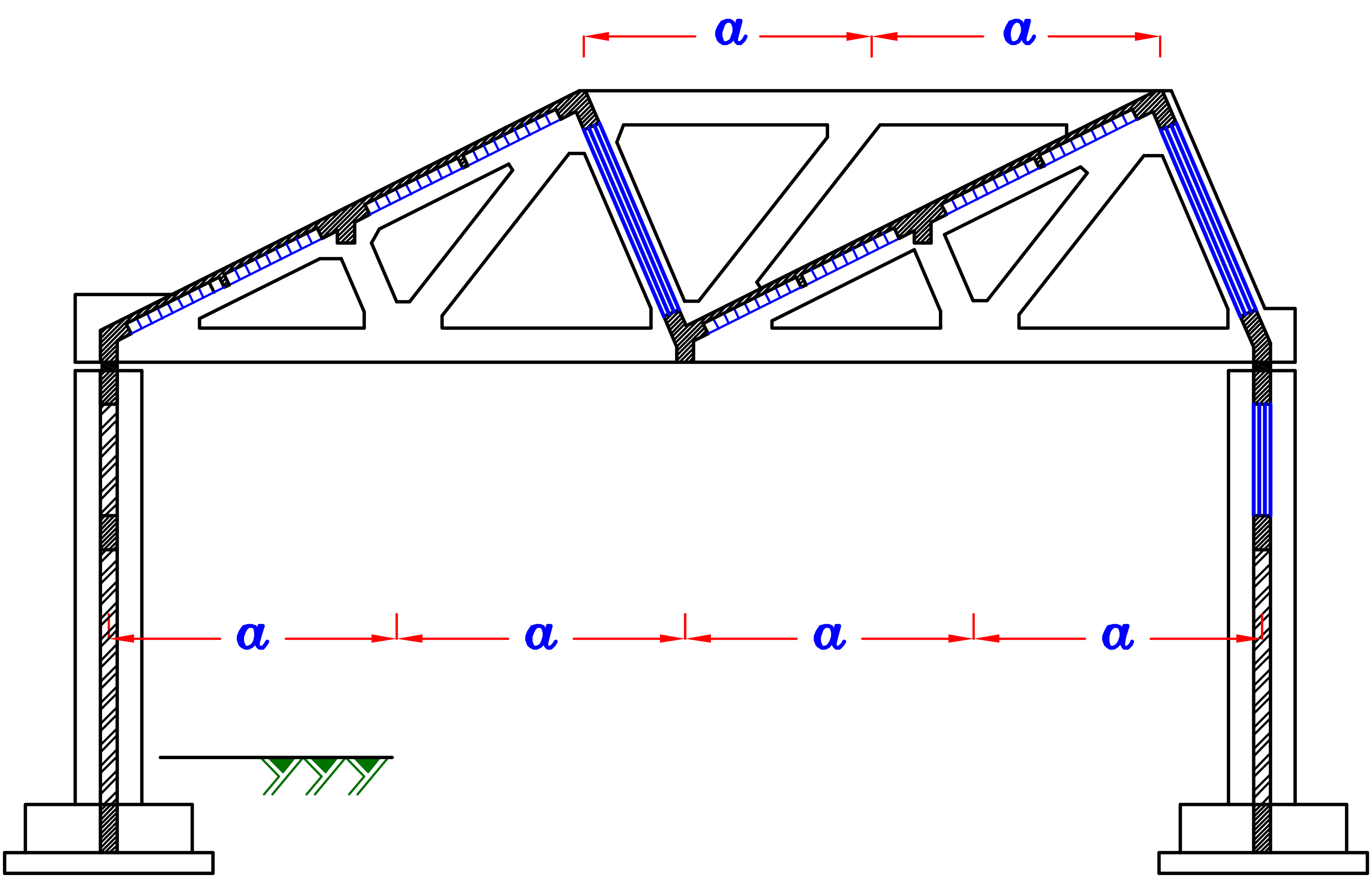
و لان طول **members** ال **Truss** يجب أن لا تزيد عن ٦٫٠ م

يجب أن يكون **Subdivided Truss**

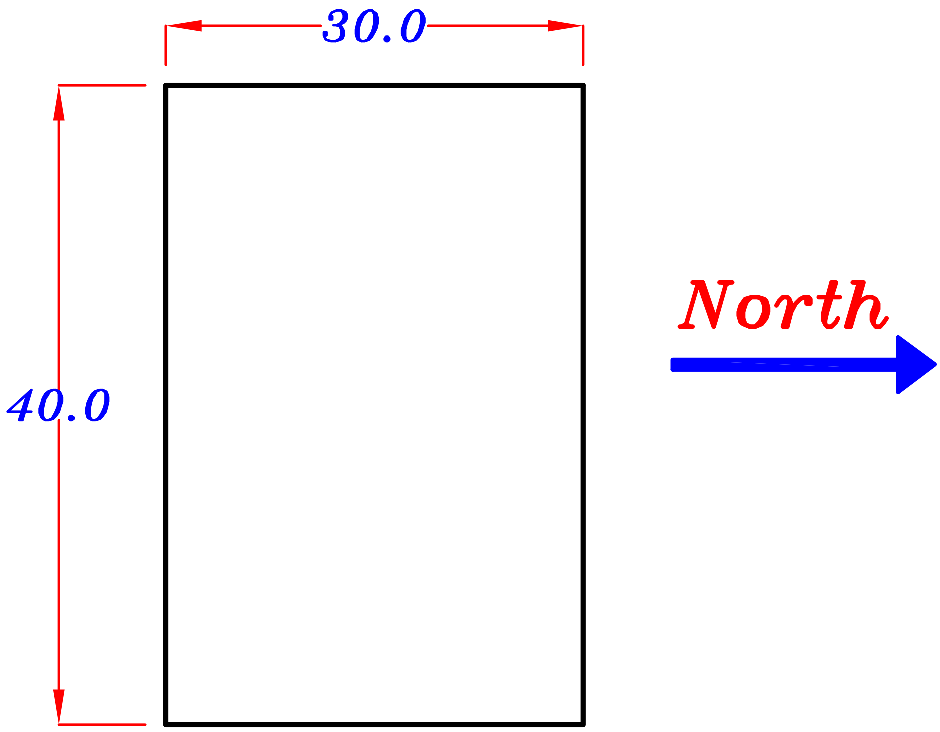


Subdivided Truss





Example.



Data.

$F_{cu} = 25 \ N\backslash mm^2$

$F_y = 360 \ N\backslash mm^2$

$L.L. + F.C. = 1.50 \ kN\backslash m^2$ (**Horizontal Projection**)

Columns allowed only along the Parameter

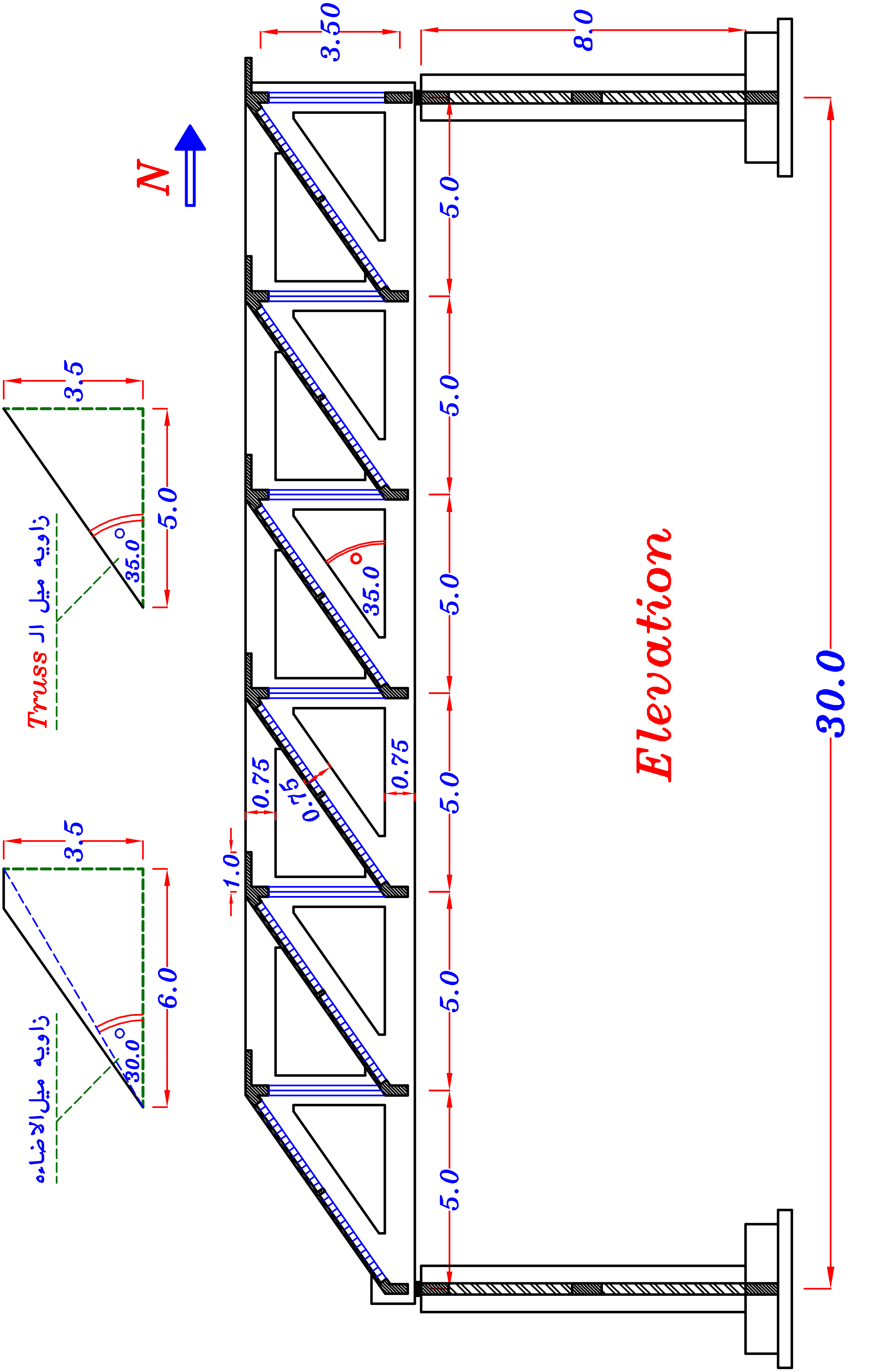
$o.w._{(Block)} = 160 \ N$

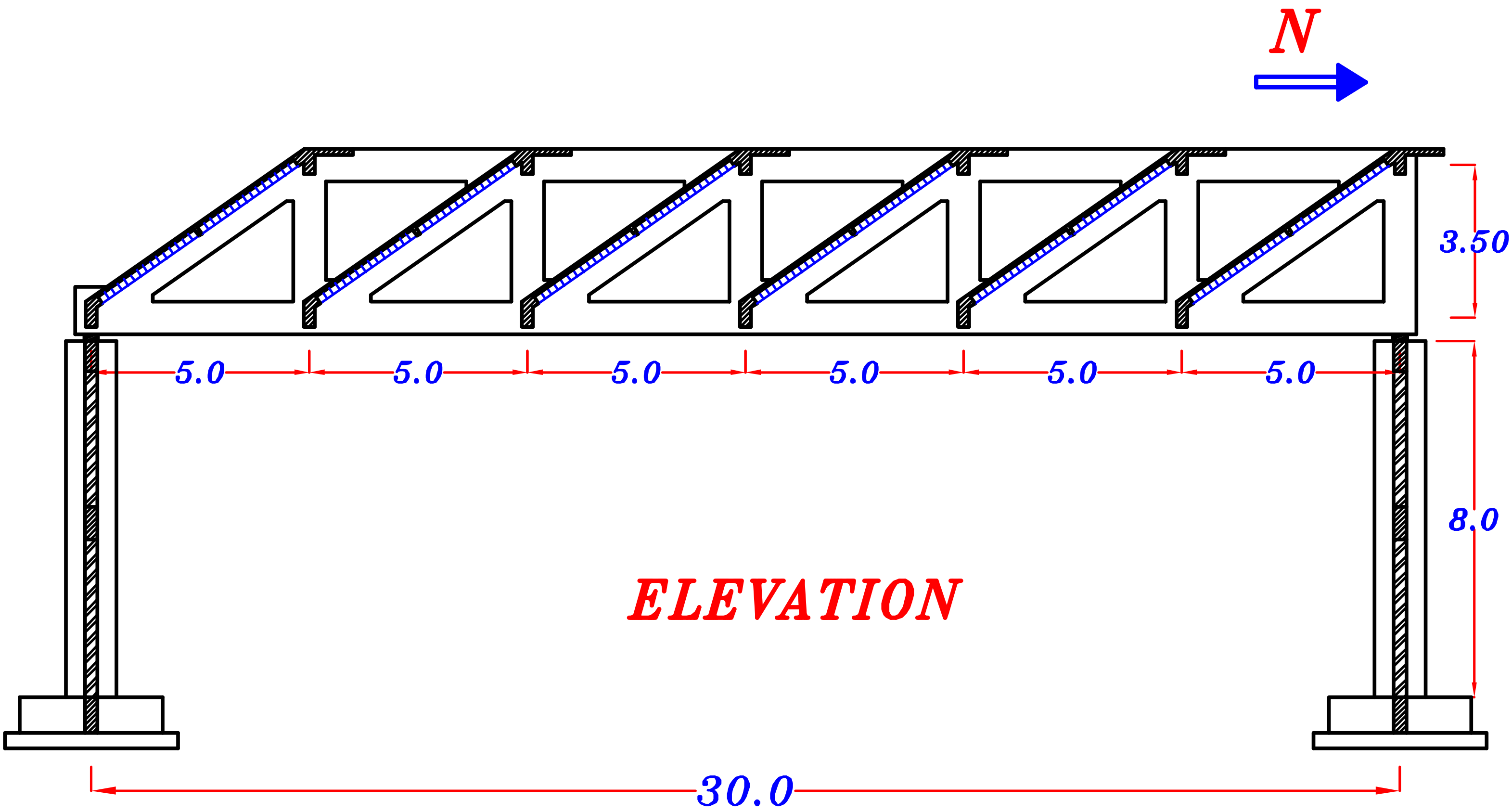
Req.

1- Draw elevation & plan of the main system. showing concrete Dimensions to scale 1:50

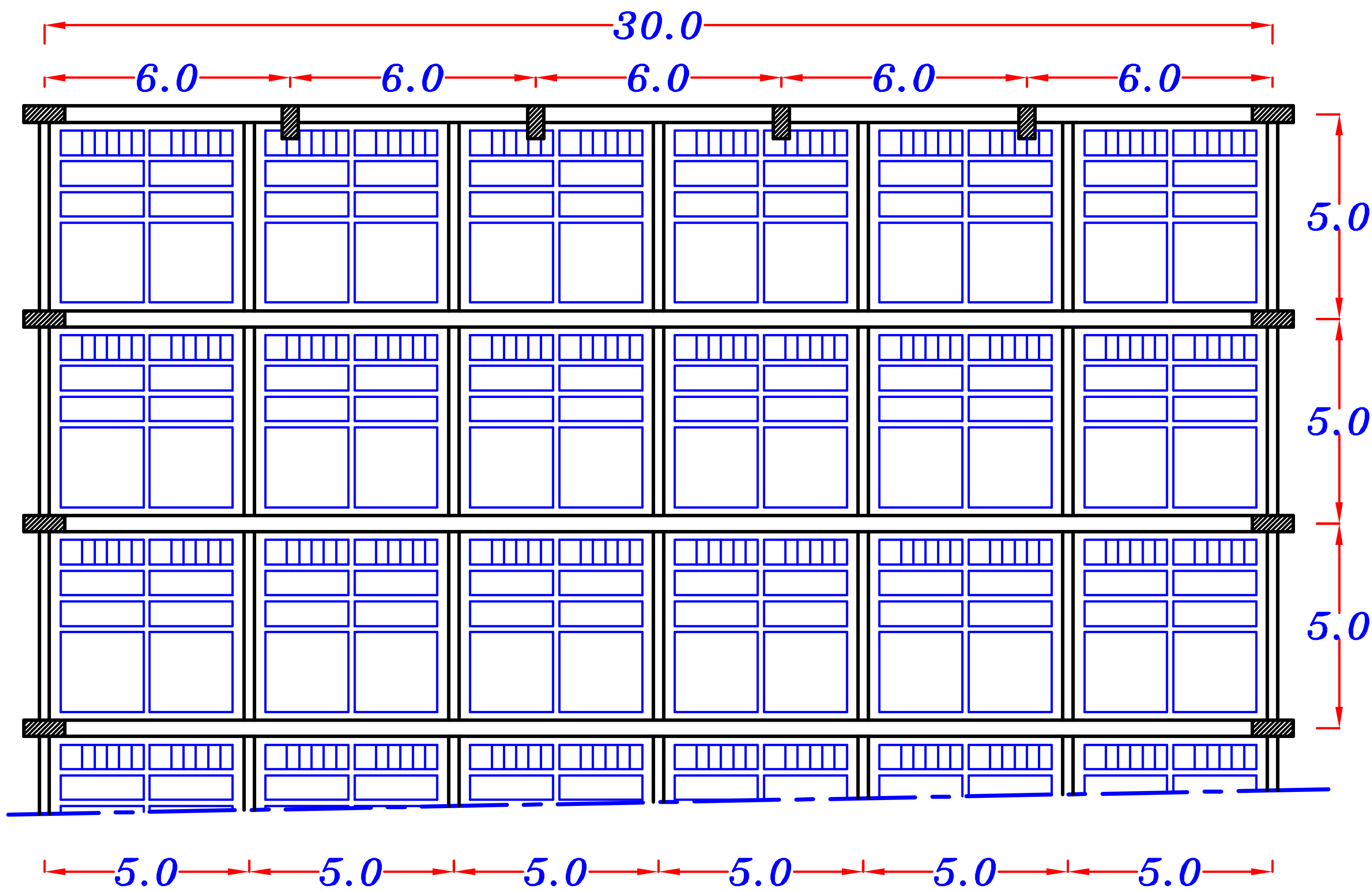
2- Design the Roof Slab and show details of RFT. on Structural plan to scale 1:50

3- Design the main carrying element and show the Details of RFT.


Elevation
N
3.50
8.0
5.0
5.0
5.0
5.0
5.0
5.0
30.0
0.75
0.75
0.75
1.0
35.0°
3.5
5.0
35.0°
زاويه ميل ال Truss
3.5
6.0
30.0°
زاويه ميل الاضاءه



ELEVATION



PLAN

Design the Slab.

For Cantilever solid slab. $t_s = \frac{L_c}{10} = \frac{1000}{10} = 100 \text{ mm}$

$$w_s = 1.4\,(t_s\,\gamma_c) + 1.5\,(F.C. + L.L.) = 1.4\,(0.10 * 25) + 1.5\,(1.50) = 5.75 \text{ kN/m}^2$$

For H.B. slab $\alpha = 30.0^\circ$ $\quad t = \frac{6100}{25} = 244 \text{ mm} = 250 \text{ mm}$

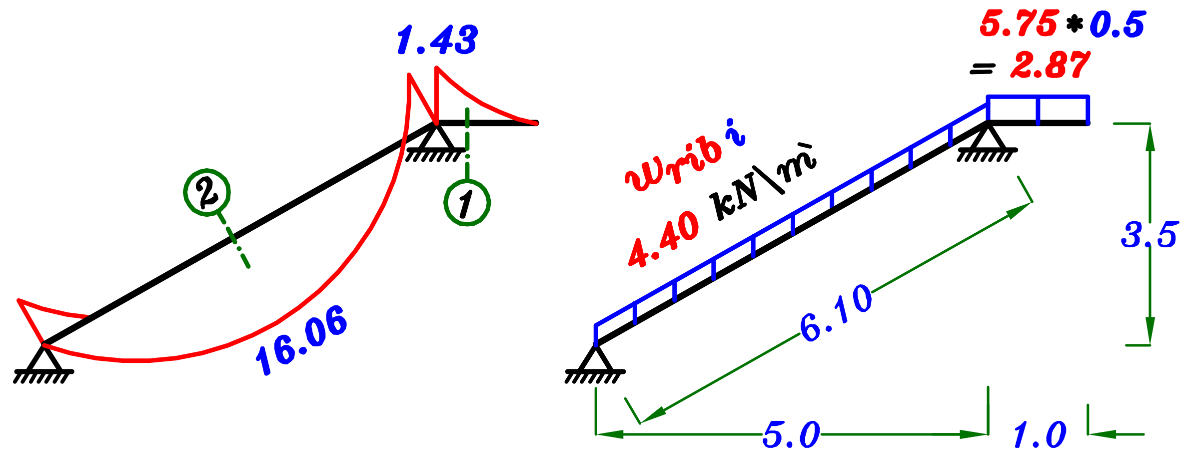
$\boxed{t = 250 \text{ mm}}$ $\quad \boxed{t_s = 50 \text{ mm}}$ $\quad \boxed{h = 200 \text{ mm}}$

$$\boxed{w_{ribi} = \left[1.4\,(t_s\gamma_c + F.C.) + 1.6\,(L.L.)\cos\alpha\right](S * 1.0) + 1.4\,(b\,h * 1.0\,m * \gamma_c) + 1.4 * (\text{Block وزن ال})\left(\frac{1.0}{a}\right)}$$

$$\therefore\ w_{ribi} = \left[1.4\,(0.05 * 25 + 1.5) + 1.6\,(1.0)\cos 35^\circ\right](0.50 * 1.0) + 1.4\,(0.10 * 0.20 * 1.0 * 25) + 1.4\left(\frac{160}{1000}\right)\left(\frac{1.0}{0.2}\right) = 4.40$$

$(kN\backslash(1.0 * S\ m^2))$

Strip in the slab.



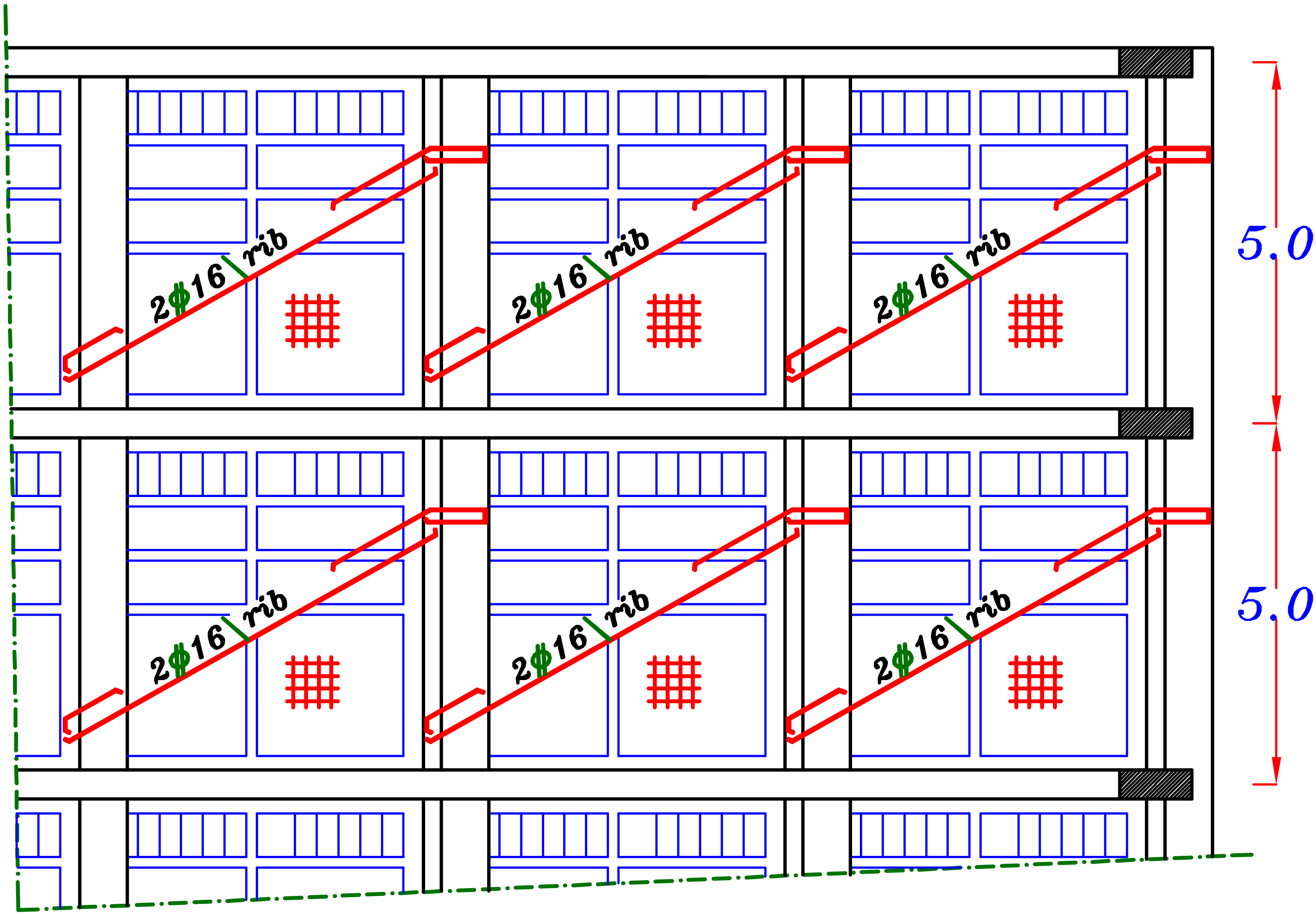
Sec. 1 $\quad M = 1.43 \text{ kN.m}\backslash 0.5 \text{ m}$ $\quad \boxed{5\phi 10\backslash m}$

Sec. 2 $\quad M = 16.06 \text{ kN.m}\backslash\text{rib}$ $\quad d = t - 30 \text{ mm} = 250 - 30 = 220$

$$\therefore\ 220 = C_1\sqrt{\frac{16.06 * 10^6}{25 * 500}} \longrightarrow C_1 = 6.13 \longrightarrow J = 0.826$$

$$A_s = \frac{M}{J\,F_y\,d} = \frac{16.06 * 10^6}{0.826 * 360 * 220} = 245.5 \text{ mm}^2\backslash\text{rib}$$ $\boxed{2\phi 16\backslash rib}$

RFT. of the Slab.

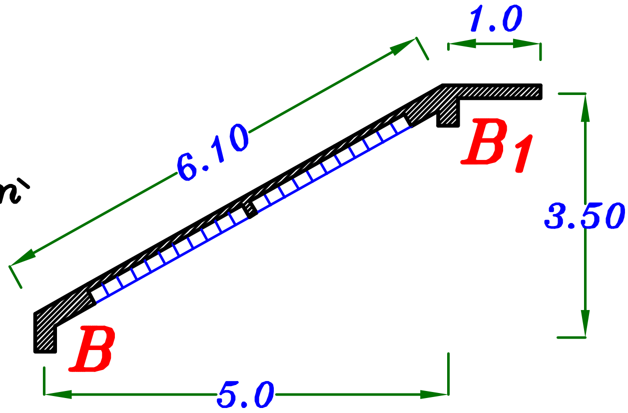


Loads on Beam B

$$W = o.w. + \left(\frac{w_{rib}}{S}\right)\left(\frac{L`}{2}\right)$$

$$= 3.0 * 1.4 + \left(\frac{4.40}{0.5}\right)\left(\frac{6.10}{2}\right) = 31.04 \ kN\backslash m`$$

$$R = 31.04 * 5.0 = 155.2 \ kN$$



Loads on Beam B_1

$$W = o.w. + \left(\frac{w_{rib}}{S}\right)\left(\frac{L`}{2}\right) + w_s L_c$$

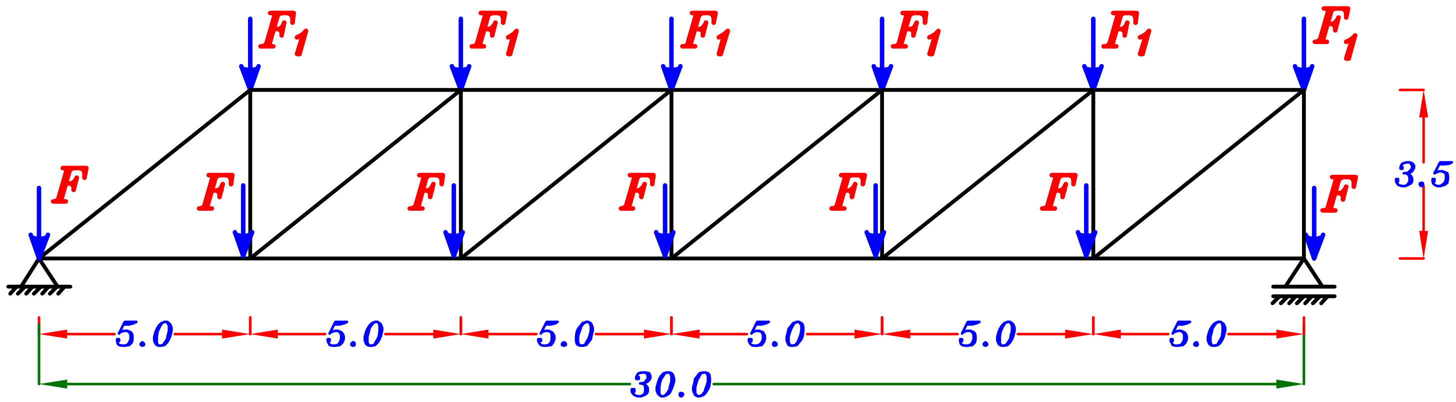
$$= 3.0 * 1.4 + \left(\frac{4.40}{0.5}\right)\left(\frac{6.10}{2}\right) + 5.75 * 1.0 = 36.79 \ kN\backslash m`$$

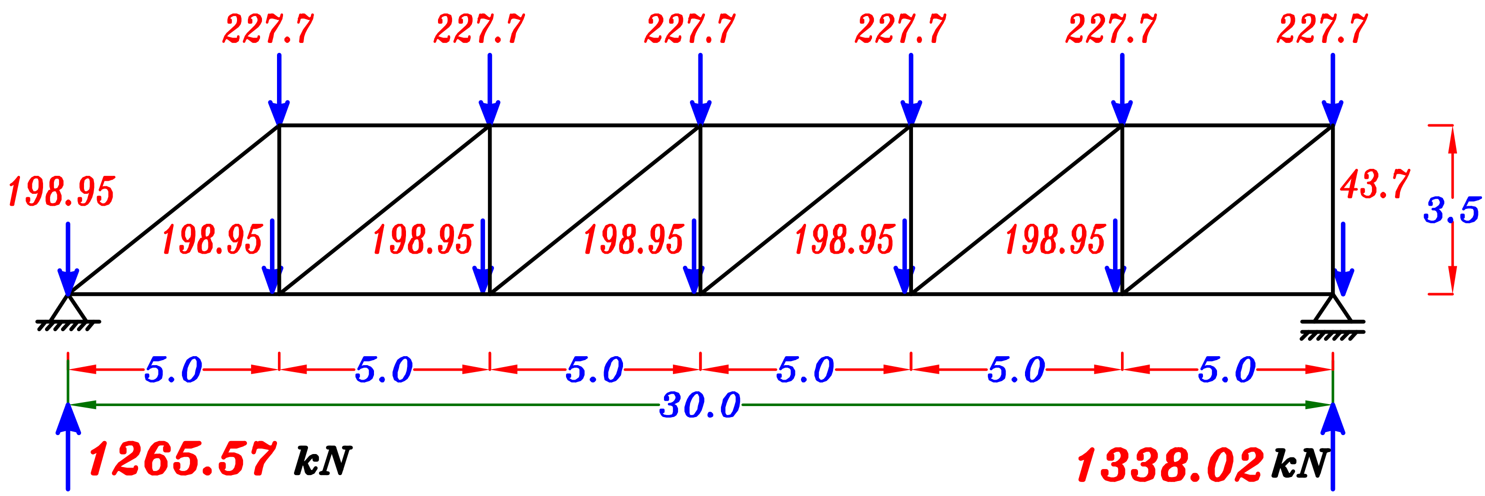
$$R_1 = 36.79 * 5.0 = 183.95 \ kN$$

Take $O.W.(\text{Truss}) = 17.5 \ kN\backslash m`$ (U.L.)

$$F = R + \frac{o.w. * a}{2} = 155.2 + \frac{17.5 * 5.0}{2} = 198.95 \ kN$$

$$F_1 = R_1 + \frac{o.w. * a}{2} = 183.95 + \frac{17.5 * 5.0}{2} = 227.7 \ kN$$



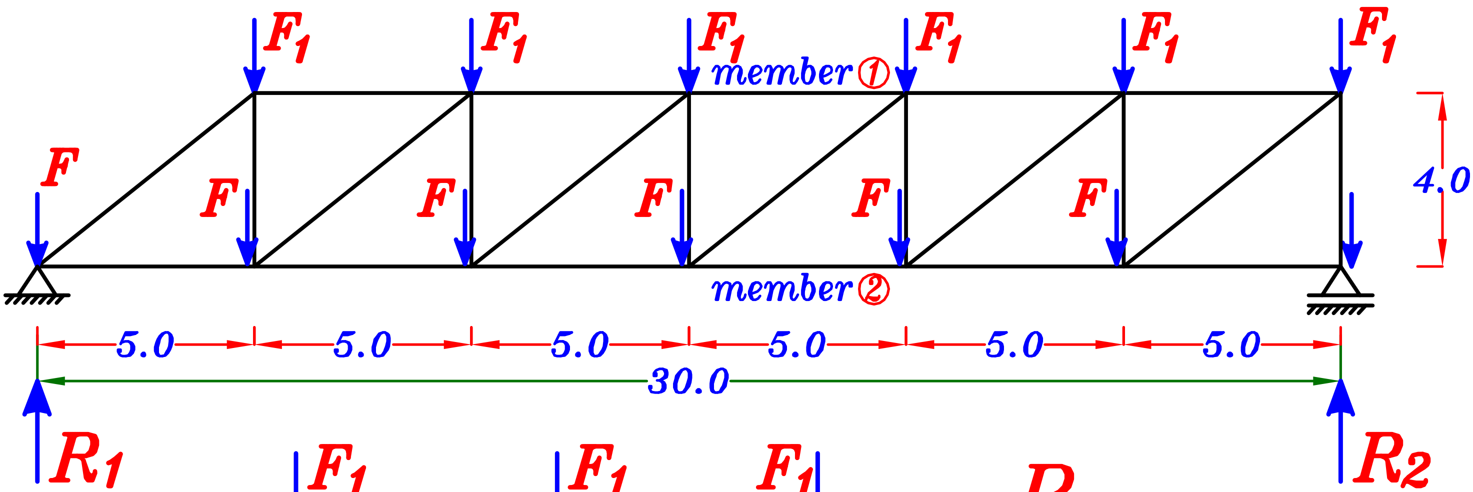


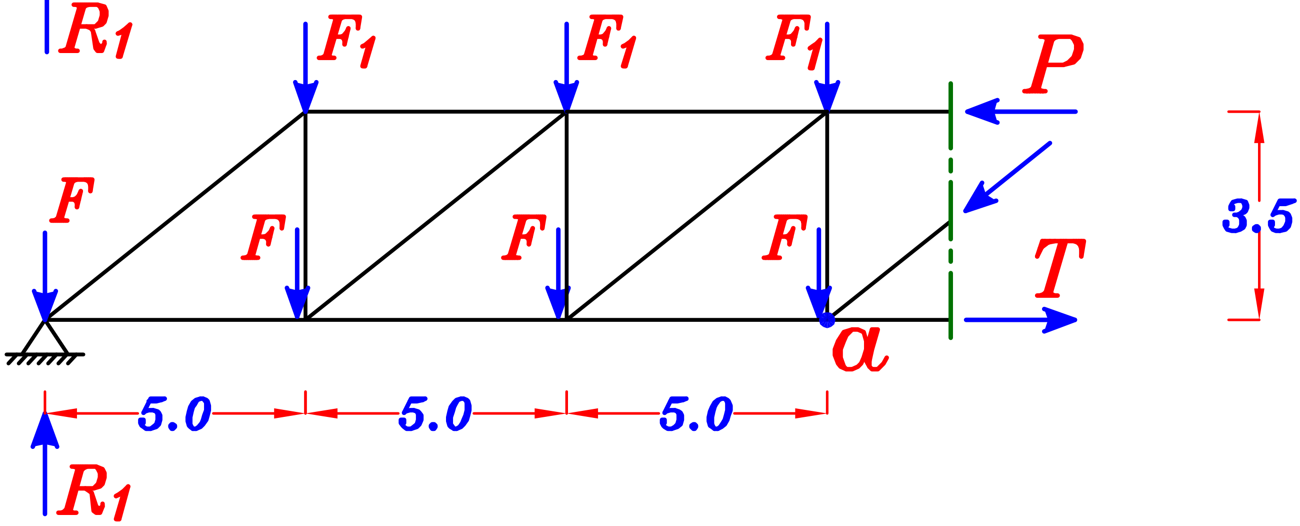
بالطبع لا يوجد وقت لحل ال Truss بالكامل

لذا سنأتى بالقوى فى 2 Members فقط هما أكبر Compression Force

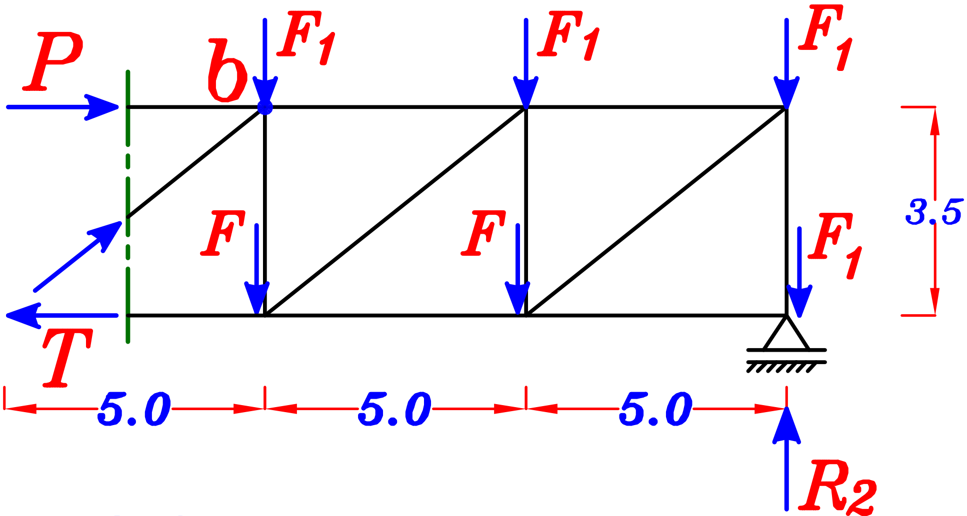
و أكبر Tension Force و نصممهم و نضع تسليحهم فى باقى ال Truss

و يفضل استخدام Method of sections

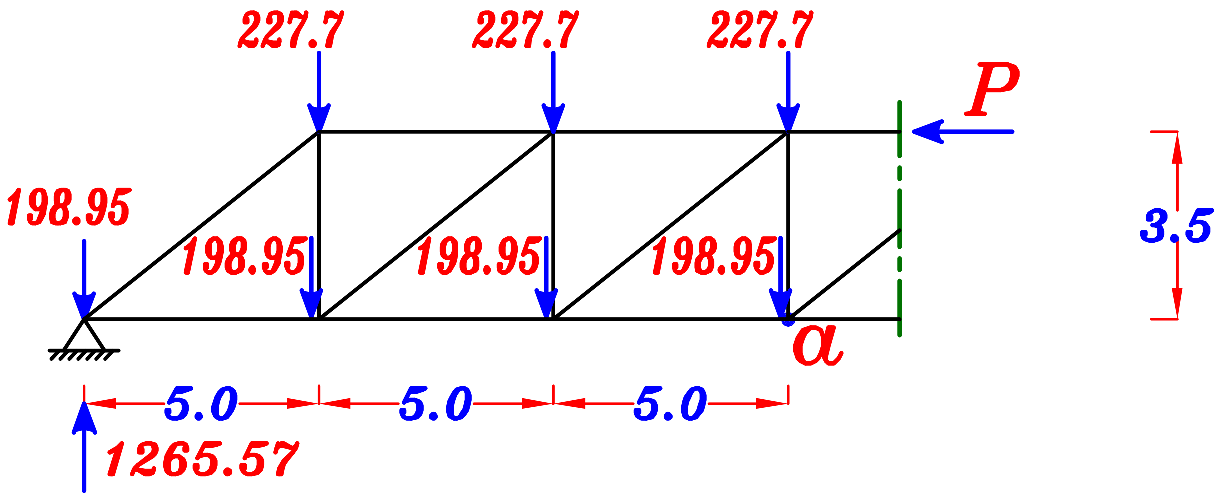




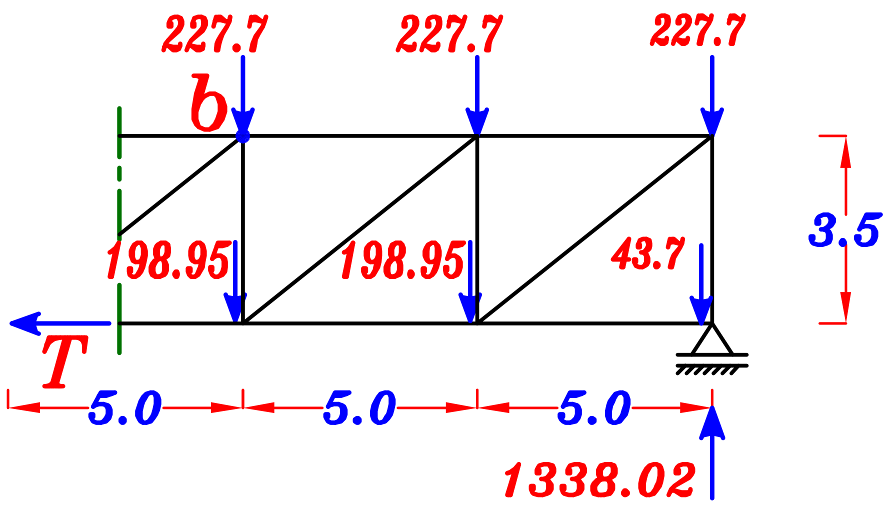
$\sum M$ at joint a = Zero $\xrightarrow{Get}$ Comp. Force at member ①



$\sum M$ at joint b = Zero $\xrightarrow{Get}$ Ten. Force at member ②



$$\because \quad \sum M \text{ at joint } a = Zero \longrightarrow P = 2742.73 \text{ kN}$$

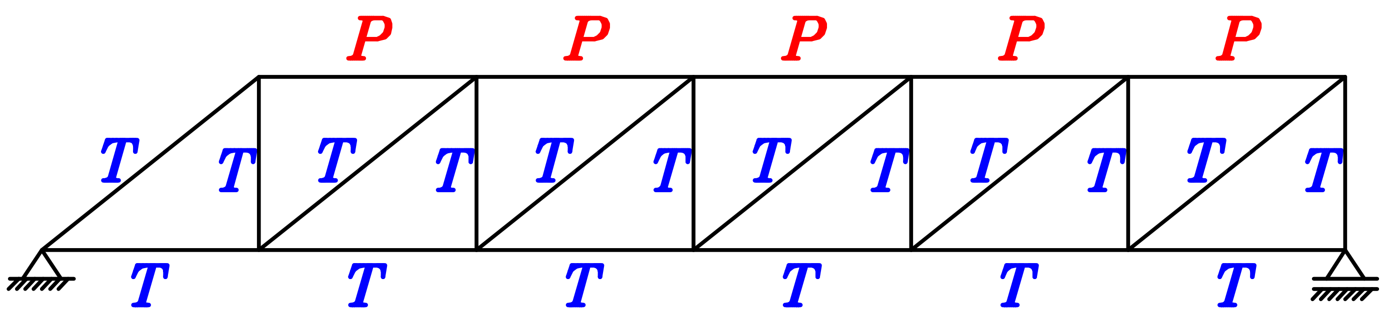


$$\sum M \text{ at joint } b = Zero \longrightarrow T = 2437.98 \text{ kN}$$

ملحوظه

اثناء الدراسه اذا لم نتأكد اذا كان الـ member عليه Tension

أم Compresion نسلح الـ member على أن عليه Tension



* **Design of members.**

Comp. Member. (300 * 750)

$P = 2453.05$ kN , $\frac{e}{t} = 0.1 \longrightarrow e = \frac{M}{P} = 0.1 * t$

$e = \frac{M}{2742.73} = 0.1 * 0.75 \longrightarrow M = 205.70$ kN.m

$\zeta = \frac{0.75 - 0.1}{0.75} = 0.9 \xrightarrow{use}$ ECCS Page 4-23

$$\left.\begin{aligned} \frac{P_U}{F_{cu}\, b\, t} &= \frac{2742.73 * 10^3}{25 * 300 * 750} = 0.487 \\ \frac{M_U}{F_{cu}\, b\, t^2} &= \frac{205.70 * 10^6}{25 * 300 * 750^2} = 0.048 \end{aligned}\right\} \rho = 3.8$$

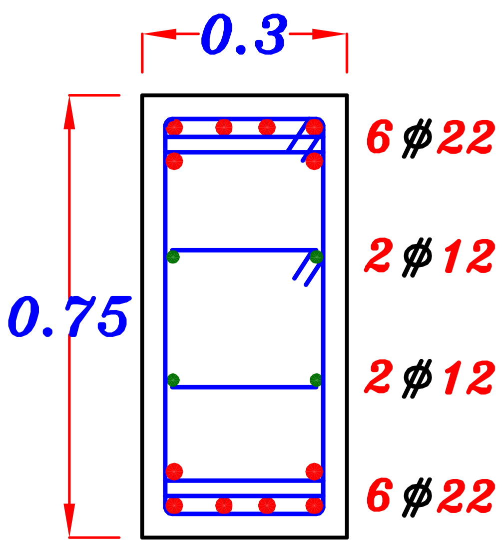
$$A_s = A_s` = \mu * b * t = \rho * F_{cu} * 10^{-4} * b * t$$

$$= 3.8 * 25 * 10^{-4} * 300 * 750 = 2137.5 \ mm^2$$

- Check $A_{s_{min.}} = \frac{0.8}{100} * b * t = \frac{0.8}{100} * 300 * 750 = 1800 \ mm^2$

$A_{s_{Total}} = A_s + A_s` = 2 * 2137.5 = 4275 \ mm^2 > A_{s_{min.}}$

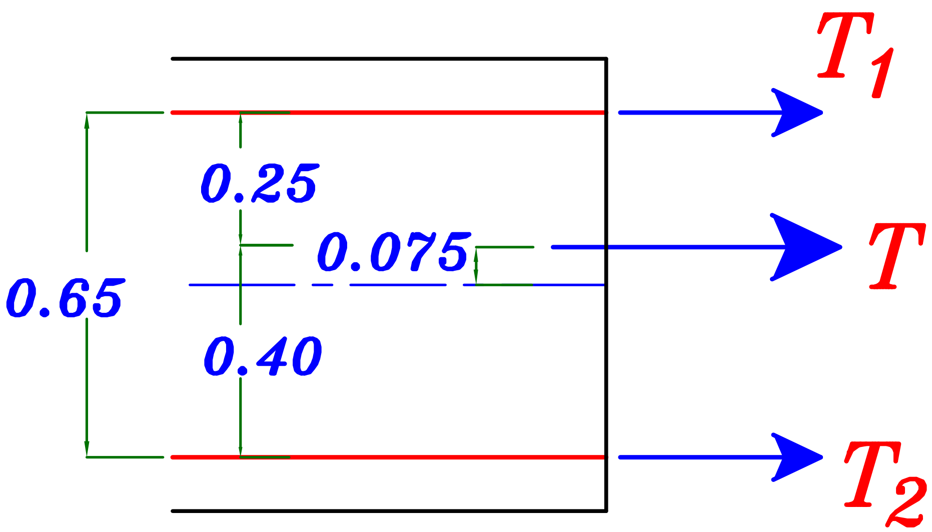
$\therefore$ take $A_s = A_s` = 2137.5 \ mm^2$ 6 ϕ 22



Ten. Member. $(300*750)$

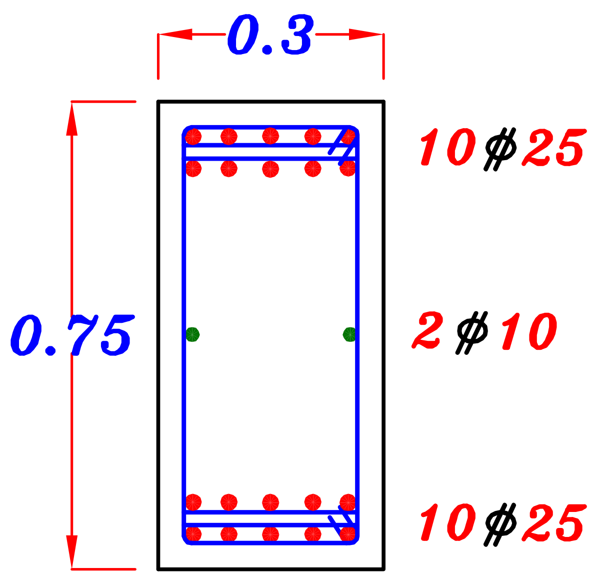
$T = 2437.98\ kN \quad , \quad \frac{e}{t} = 0.1 \longrightarrow e = 0.1*t$

$\therefore\ e = 0.1\ (0.75) = 0.075\ m$



$T\ (0.40) = T_1\ (0.65) \longrightarrow T_1 = 1500.29\ kN$

$A_{s1} = \frac{T_1}{F_y \backslash \gamma_s} = \frac{1500.29 * 10^3}{360 \backslash 1.15} = 4792.6\ mm^2$ $\quad 10 \phi 25$

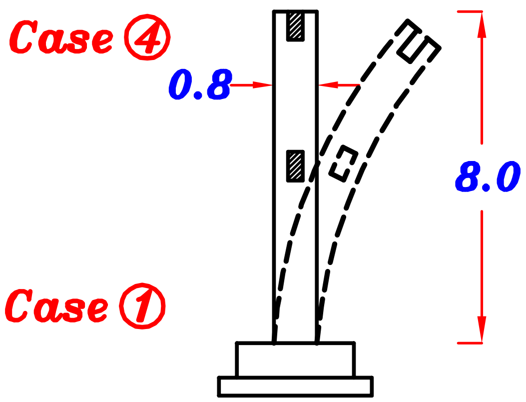


Design the Column. (300*800)

$P = 1338.02\ kN$

Check Buckling.

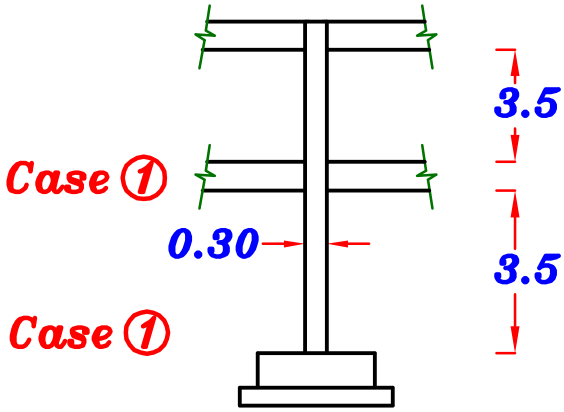
① In plane.



$H_o = 8.0\ m$

$$\lambda_b = \frac{K * H_o}{t} = \frac{2.2 * 8.0}{0.8} = 22.0 > 10$$

② Out of plane.



$H_o = 3.5\ m$

$$\lambda_b = \frac{K * H_o}{b} = \frac{1.2 * 3.5}{0.30} = 14$$

$$\delta = \frac{(\lambda_b)^2 * t}{2000} = \frac{22.0^2 * 0.80}{2000} = 0.193\ m$$

$$M_{add.} = P * \delta = 1338.02 * 0.193 = 258.23\ kN.m$$

$$e = \frac{M}{P} = \frac{258.23}{1338.02} = 0.193\ m$$

$$\therefore \frac{e}{t} = \frac{0.193}{0.8} = 0.241 < 0.5 \xrightarrow{use} I.D.$$

$$\zeta = \frac{0.8 - 0.1}{0.8} = 0.8 \xrightarrow{use} \text{ECCS Page } 4\text{–}24$$

$$\frac{P_U}{F_{cu}\, b\, t} = \frac{1338.02 * 10^3}{25 * 300 * 800} = 0.22$$

$$\frac{M_U}{F_{cu}\, b\, t^2} = \frac{258.23 * 10^6}{25 * 300 * 800^2} = 0.053$$

$$\left.\begin{matrix} 0.22 \\ 0.053 \end{matrix}\right\} \rho < 1.0 \xrightarrow{Take} \rho = 1.0$$

$$\mu = \rho * F_{cu} * 10^{-4} = 1.0 * 25 * 10^{-4} = 2.5 * 10^{-3}$$

$$A_s = A_s` = \mu * b * t = 2.5 * 10^{-3} * 300 * 800 = 600\ mm^2$$

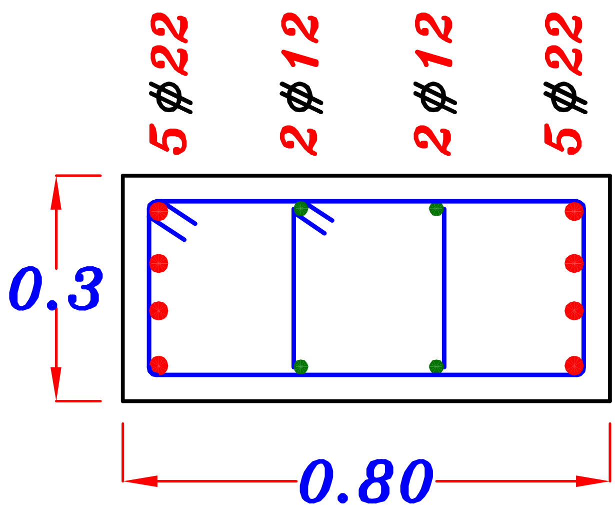
$$A_{s\,total} = A_s + A_s` = 1200\ mm^2$$

$$A_{s\,min} = \frac{0.25 + 0.052\, \lambda_{max}}{100} * b * t$$

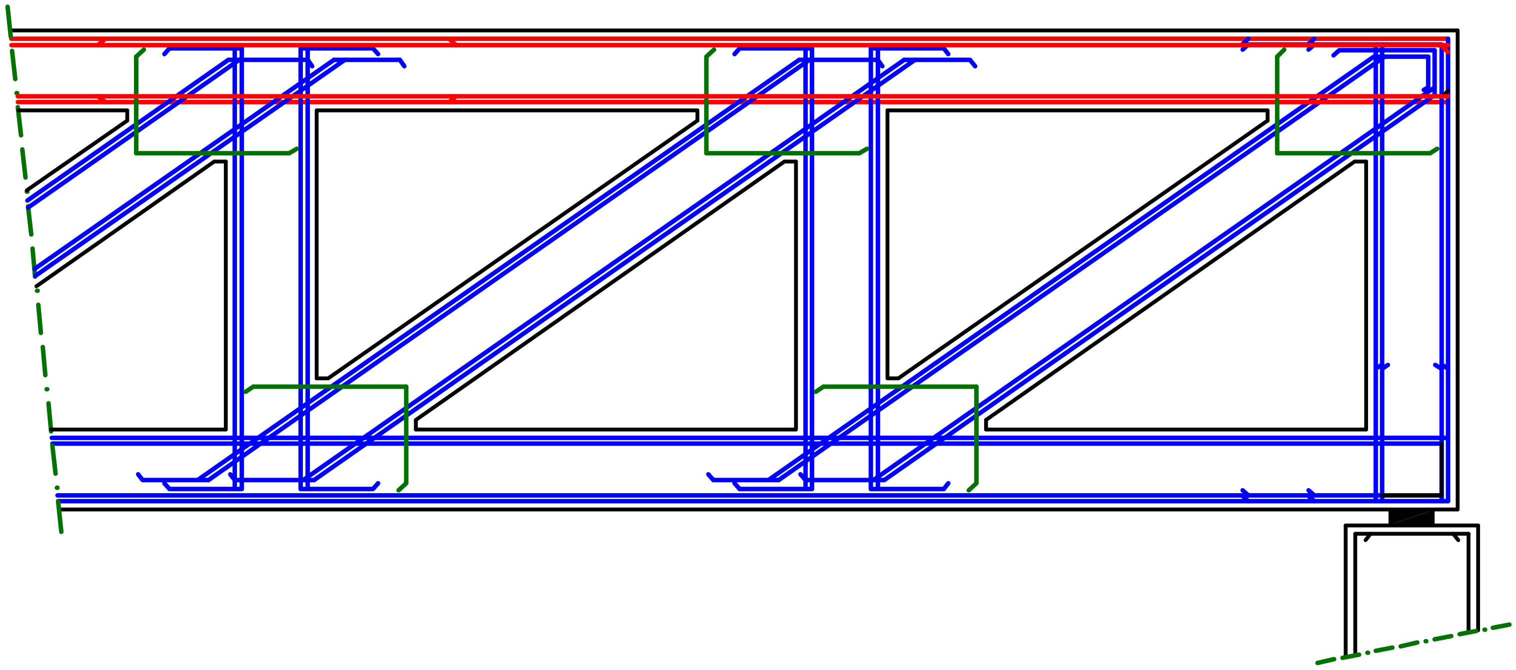
$$= \frac{0.25 + 0.052\,(22.0)}{100} * 300 * 800 = 3345.6\ mm^2 > A_{s\,total}$$

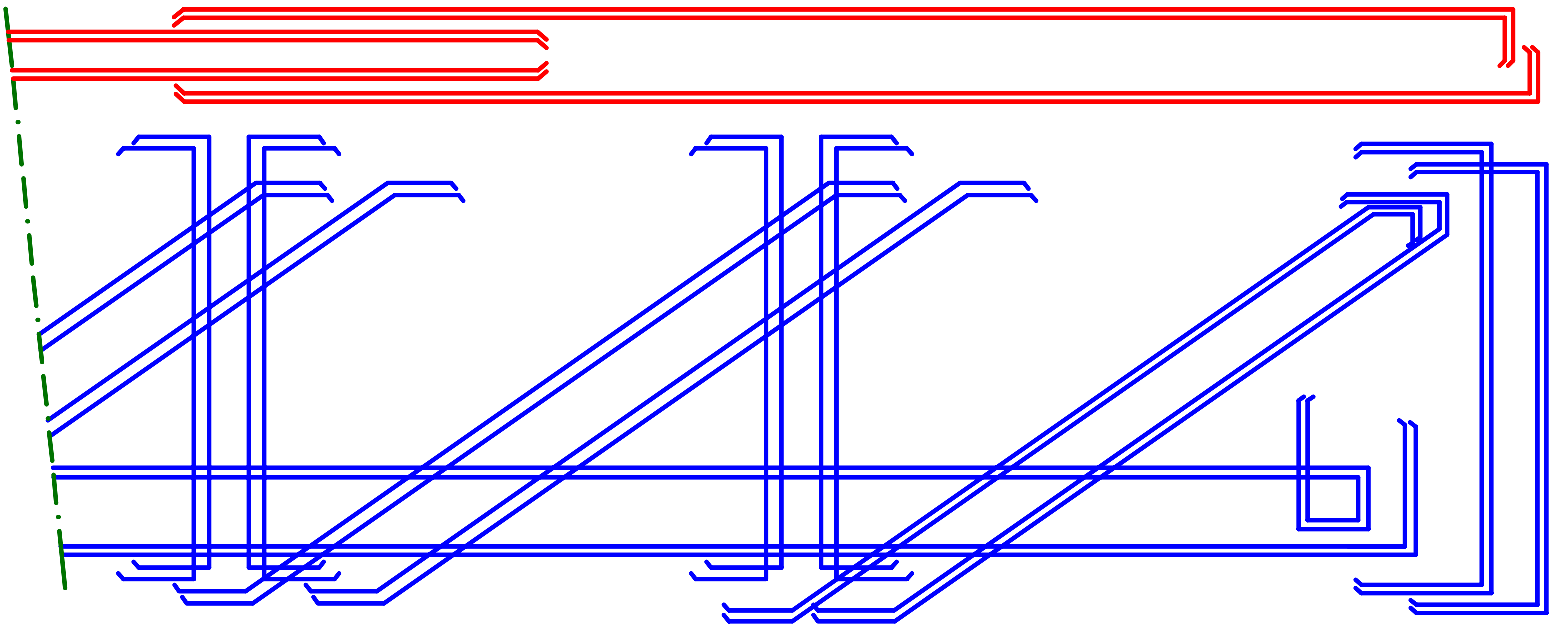
$\therefore$ O.K.

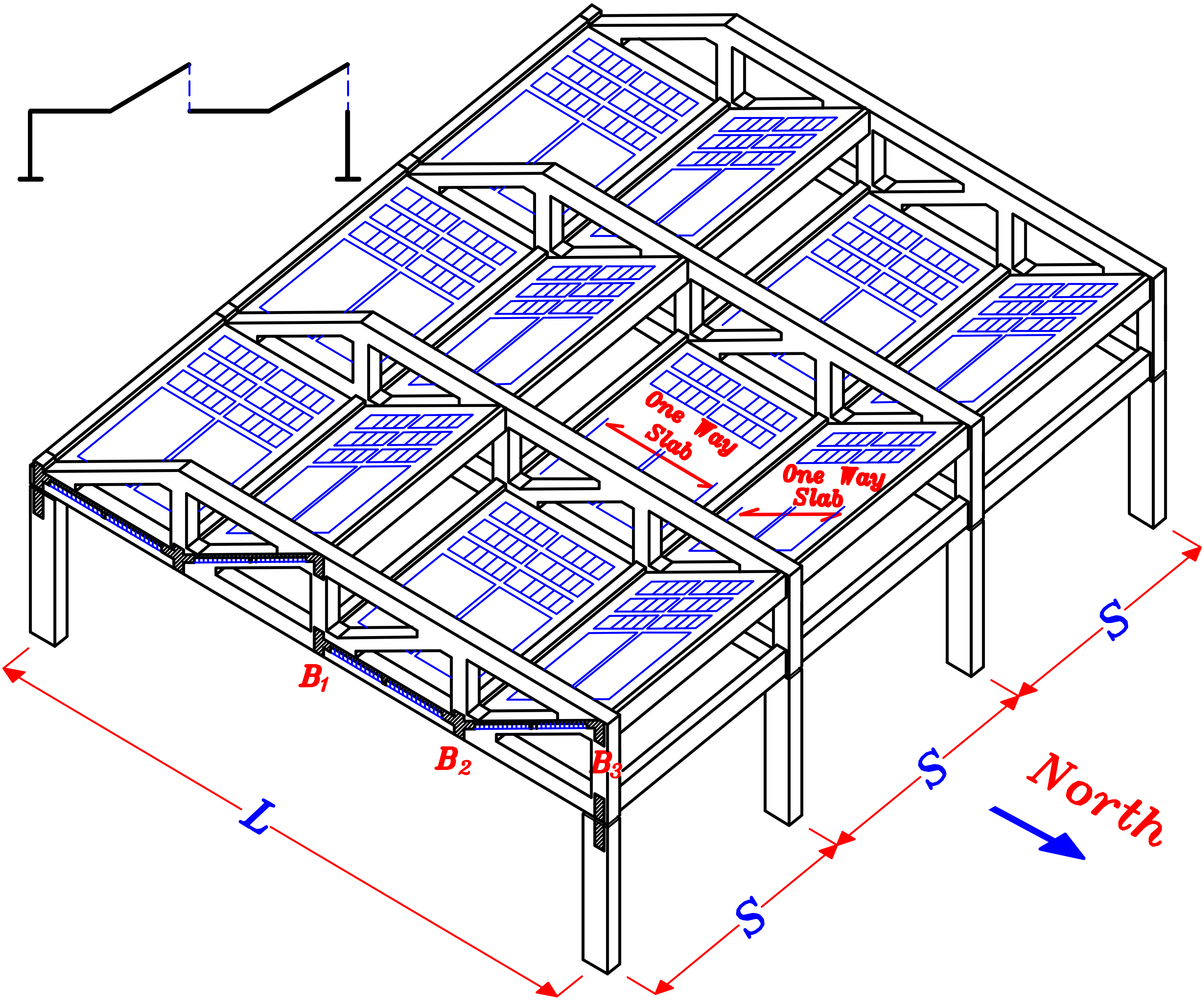
$$A_s = A_s` = \frac{A_{s\,min}}{2} = \frac{3345.6}{2} = 1672.8\ mm^2 \quad 5\phi22$$

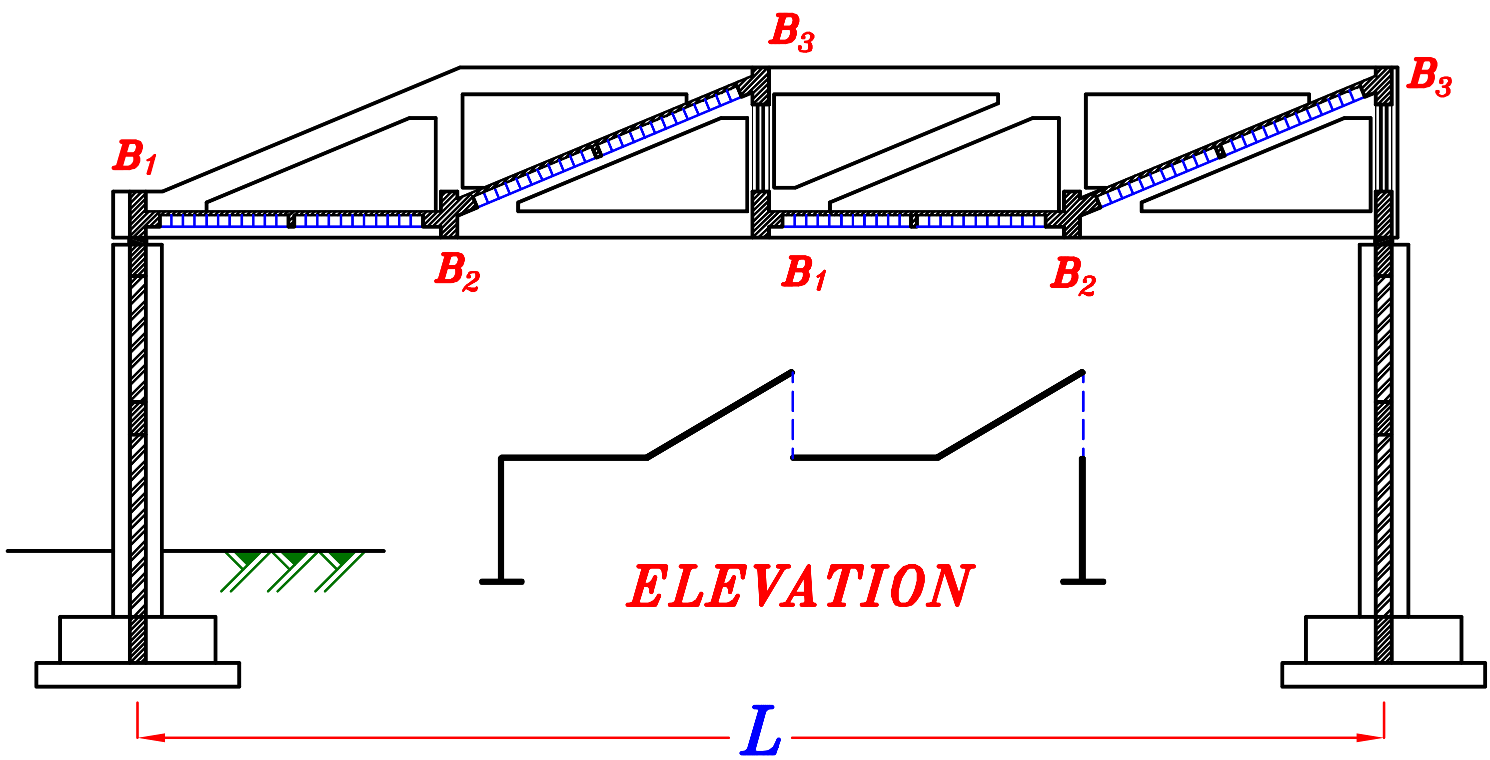


RFT. of the Truss.

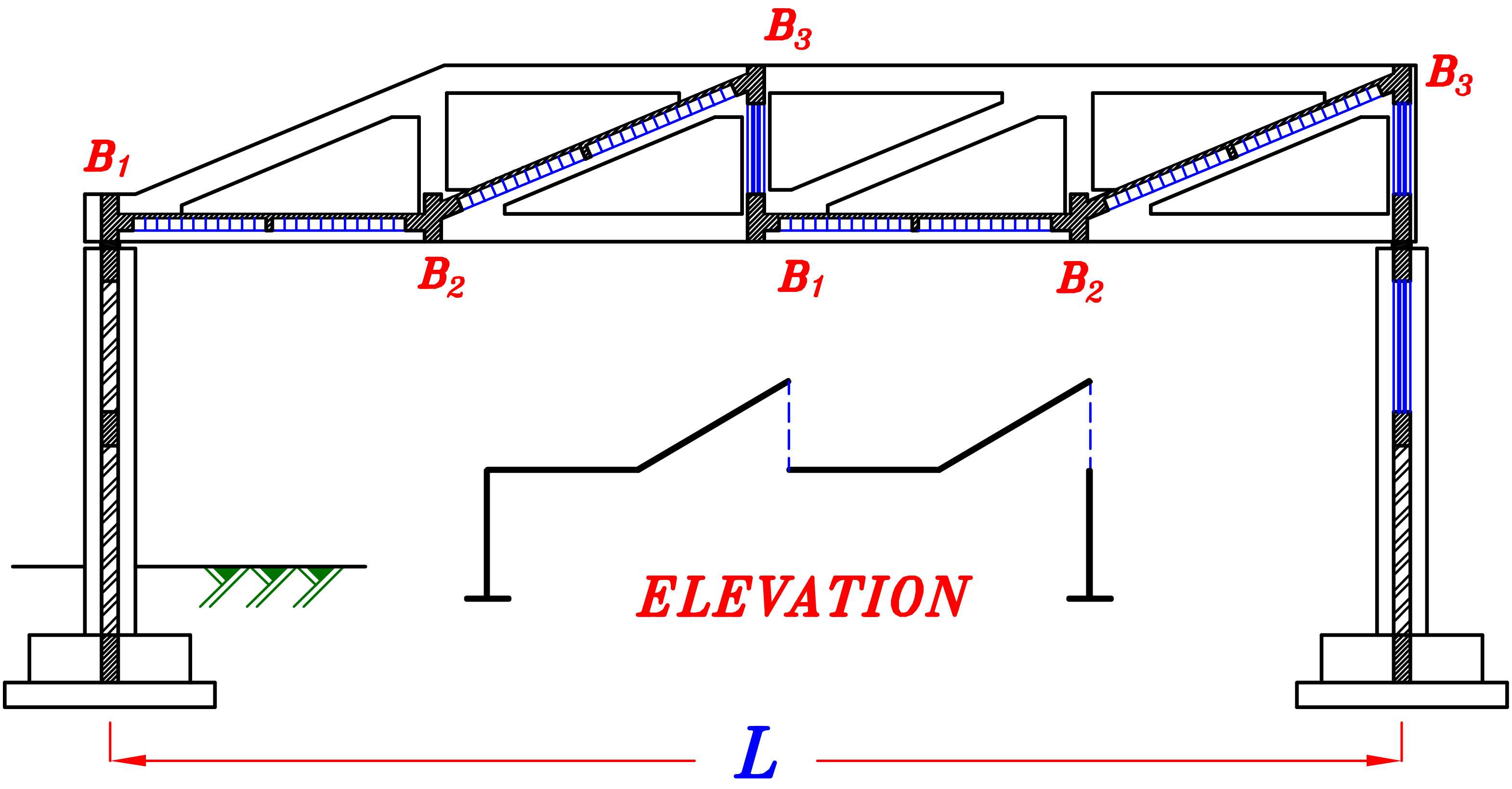


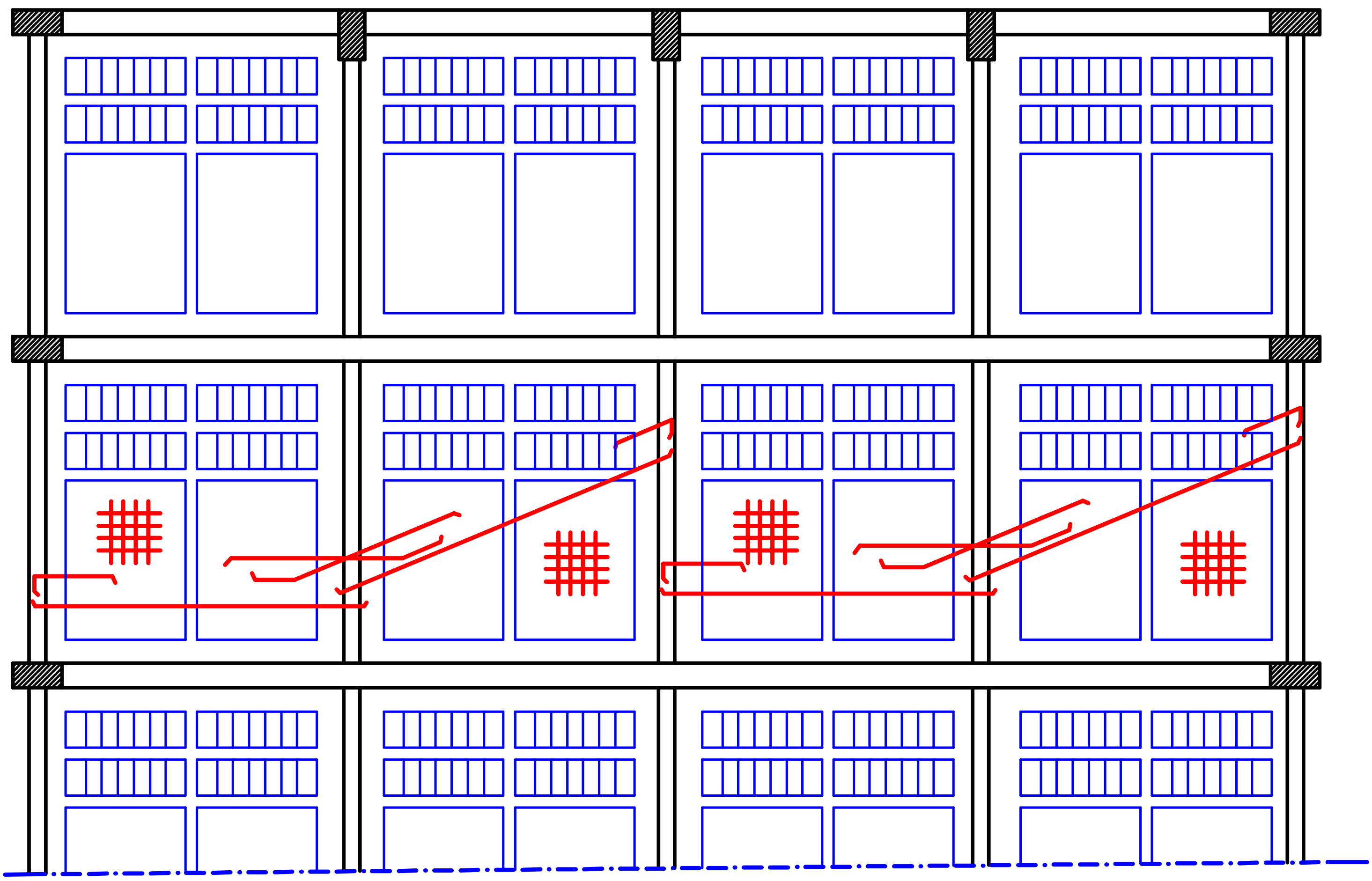






ELEVATION





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